The City of National City

STANDARD URBAN STORM WATER MITIGATION PLAN (SUSMP) MANUAL

Adopted January 2011

Table of Contents

GLOSSARY

HOW TO USE THE STORM WATER BEST MANAGEMENT PRACTICES MANUAL 1
► Plan Ahead to Avoid the Three Most Common Mistakes 2

CHAPTER 1. POLICIES AND PROCEDURES 3

Background 3

Legal Framework 4

A Low Impact Development Design Procedure 5

Requirements for All Development Projects 5

Priority Development Projects 6
► New Development 6
► Previously Developed Sites 6
► The "50% Rule" for Previously Developed Projects 7
► Pollutant generating projects which distrub one acre or more of land 7

Project Review and Permitting Process 7

Compliance Process at a Glance 9
► Additional Notes on Compliance 10

Phased Projects 10

New Subdivisions 11

Compliance with Flow-Control Requirements 12
► HMP Applicability Requirements 12
► Flow Control Performance Criteria 19

Waivers from Numeric Sizing Criteria 30

CHAPTER 2. CONCEPTS AND CRITERIA 31

Water-Quality Regulations 32
► Maximum Extent Practicable 33
► Best Management Practices 33

Pollutants of Concern 33
► Grouping of Potential Pollutants of Concern 33

► Identifying Pollutants of Concern Based on Land Uses 35
► Watersheds with Special Pollutant Concerns 35

Selection of Permanent Source Control BMPs 38

Selection of Storm Water Treatment Facilities 38

Hydrology for NPDES Compliance 41
► Imperviousness 41
► Low Impact Development Requirements 42
► Sizing Requirements for Storm Water Treatment Facilities 42
► Flow-Control (Hydromodification Management) 43

Criteria for Infiltration Devices 43
► Most LID Features and Facilities Are Not Infiltration Devices 44

CHAPTER 3. PREPARING YOUR PROJECT SUBMITTAL 46

Step by Step 49

Step 1: Assemble Needed Information 49

Step 2: Identify Constraints & Opportunities 51

Step 3: Prepare and Document Your LID Design 51

Step 4. Specify Source Control BMPs 52
► Identify Pollutant Sources 53
► Note Locations on Submittal Drawing 53
► Prepare a Table and Narrative 53
► Identify Operational Source Control BMPs 53

Step 5: Storm Water Facility Maintenance 54

Step 6: Complete Your Project Submittal 54
► Coordination with Site, Architectural, and Landscaping Plans 54
► Construction Plan SUSMP Checklist 55
► Certification 56
► Example Project Submittal Outline and Contents 57
► Specific Project Considerations 59

CHAPTER 4. LOW IMPACT DEVELOPMENT DESIGN GUIDE 60

Analyze Your Project for LID 61
► Optimize the Site Layout 62
► Use Pervious Surfaces 64
► Disperse Runoff to Adjacent Pervious Areas 64
► Direct Runoff to Integrated Management Practices 64

Develop and Document Your Drainage Design 66
► Step 1: Delineate Drainage Management Areas 66
► Step 2: Classify DMAs and Determine Runoff Factors 67

► Step 3: Tabulate Drainage Management Areas 70
► Step 4: Select and Lay Out IMPs on Site Plan 71
► Step 5: Review Sizing for Each IMP 71
► Step 6: Calculate Minimum Area and Volume of Each IMP 72
► Step 7: Determine if Available Space for IMP Is Adequate 73
► Step 8: Complete Your Summary Report 73

Specify Preliminary Design Details 75

Alternatives to Integrated LID Design 76
► Design of Alternative Treatment Facilities 76
► Treatment Facilities for Special Circumstances 79

CHAPTER 5. OPERATION & MAINTENANCE OF STORM WATER FACILITIES 80

Stage 1: Ownership and Responsibility 81
► Private Ownership and Maintenance 82
► Transfer to Public Ownership 83

Stage 2: General Maintenance Requirements 83

Stage 3: Detailed Maintenance Plan 84
► Your Detailed Maintenance Plan: Step by Step 84
► Step 1: Designate Responsible Individuals 84
► Step 2: Summarize Drainage and BMPs 85
► Step 3: Document Facilities "As Built" 85
► Step 4: Prepare Maintenance Plans for Each Facility 86
► Step 5: Compile Maintenance Plan 86
► Step 6: Updates 88

Stage 4: Interim Maintenance 89

Stage 5: Transfer Responsibility 89

Stage 6: Operation & Maintenance Verification 89

Appendices

APPENDIX A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PROJECT APPLICABILITY FORM ... 90

APPENDIX B LOW IMPACT DEVELOPMENT (LID) INTEGRATED MANAGEMENT PRACTICES (IMP) DESIGN SHEETS ... 96

APPENDIX C STORM WATER POLLUTANT SOURCES AND SOURCE CONTROL CHECKLIST ... 123

APPENDIX D BIBLIOGRAPHY AND SUGGESTED RESOURCES ... 135

APPENDIX E HYDROMODIFICATION MANAGEMENT PLAN ... 137

Figures

FIGURE 1-1 SUSMP REVIEW FLOW-CHART ... 8

FIGURE 1-2 HMP APPLICABILITY DETERMINATION ... 14

FIGURE 1-3 MITIGATION CRITERIA AND IMPLEMENTATION (PART 1) ... 22

FIGURE 1-4 MITIGATION CRITERIA AND IMPLEMENTATION (PART 2) ... 24

FIGURE 1-5 SCCWRP VERTICAL SUSCEPTIBILITY ... 28

FIGURE 1-6 LATERAL CHANNEL SUSCEPTIBILITY ... 29

FIGURE 4-1 SELF-TREATING AREAS ... 67

FIGURE 4-2 SELF-RETAINING AREAS ... 68

FIGURE 4-3 RELATIONSHIP OF IMPERVIOUS TO PERVIOUS AREA ... 68

FIGURE 4-4 MORE THAN ONE DMA CAN DRAIN TO ONE IMP ... 70

FIGURE 4-5 ONE DMA CANNOT DRAIN TO MORE THAN ONE IMP ... 70

Tables

TABLE 1-1 SUMMARY OF EXEMPT RIVER REACHES IN SAN DIEGO COUNTY ... 18

TABLE 1-2 SUMMARY OF EXEMPT RESERVOIRS IN SAN DIEGO COUNTY ... 19

TABLE 2-1 ANTICIPATED AND POTENTIAL POLLUTANTS BY LAND USE ... 36

TABLE 2-2 CITY OF NATIONAL CITY RECEIVING WATER BODIES ... 37

TABLE 2-3 GROUPING OF POTENTIAL POLLUTANTS OF CONCERN ... 38

TABLE 2-4 GROUPS OF POLLUTANTS AND RELATIVE EFFECTIVENESS OF FACILITIES ... 39

TABLE 3-1 FORMAT FOR TABLE OF SOURCE CONTROL MEASURES ... 53

TABLE 3-2 CONSTRUCTION PLAN CHECKLIST ... 55

TABLE 4-1 IDEAS FOR RUNOFF MANAGEMENT ... 62

TABLE 4-2 EXAMPLE RUNOFF FACTORS ... 69

TABLE 4-3 FORMAT FOR TABULATING SELF-TREATING AREAS ... 71

TABLE 4-4 FORMAT FOR TABULATING SELF-RETAINING AREAS 71

TABLE 4-5 FORMAT FOR TABULATING AREAS DRAINING TO SELF-RETAINING AREAS 71

TABLE 4-6 "WATER QUALITY ONLY" SIZING FACTORS 71

TABLE 4-7 FORMAT FOR PRESENTING CALCULATIONS OF MINIMUM IMP AREAS 72

TABLE 5-1 SCHEDULE FOR PLANNING BMP OPERATION AND MAINTENANCE 83

Checklists

EXAMPLE PROJECT SUBMITTAL CHECKLIST 47

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
PROJECT APPLICABILITY FORM 90

STORM WATER POLLUTANT SOURCES AND SOURCE CONTROL BMP CHECKLIST 123

Glossary

Attached Residential Development Any development that provides residential units that share an interior/exterior wall. This category includes, but is not limited to: dormitories, condominiums, and apartments.

Automotive Repair Shop A facility that is categorized in any one of the following **Standard Industrial Classification (SIC)** codes: 5013, 5014, 5541, 7532-7534, or 7536-7539.

Best Management Practice (BMP) Any procedure or device designed to minimize the quantity of pollutants that enter the storm drain system. BMPs also include treatment requirements, operating procedures and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. This manual groups storm water BMPs into the following categories: (1) Construction Storm Water BMPs, which are practices, procedures, devices or materials used to prevent the transport and introduction of pollutants both on and from a project during construction; and (2) Permanent Storm Water BMPs, which are the **Low Impact Development** design features, **source control** features, and **treatment control BMP**s that become a permanent part of a project site.

California Association of Stormwater Quality Agencies (CASQA) Publisher of the California Stormwater Best Management Practices Handbooks, available at www.cabmphandbooks.com. Successor to the Storm Water Quality Task Force (SWQTF).

California BMP Method A method for determining the required volume of storm water treatment facilities. Described in Section 5.5.1 of the California Stormwater Best Management Practice Manual (New Development) (CASQA, 2003).

Commercial Development Commercial development is defined as any development on private land that is not for heavy industrial or residential uses. The category includes, but is not limited to, hospitals; laboratories and other medical facilities; educational institutions; recreational facilities; municipal facilities; commercial nurseries; multi-apartment buildings; car wash facilities; mini-malls and other business complexes; shopping malls; hotels; office buildings; public warehouses; automotive dealerships; commercial airfields; and other light industrial facilities. Any development on private land that is not exclusively industrial or residential uses. The **Priority Development Project** category is defined as commercial developments resulting in the disturbance of one acre or more of land.

Conditions of Approval (COAs) Requirements a municipality may adopt for a project in connection with a discretionary action (e.g., adoption of an EIR or negative declaration or issuance of a use permit). COAs may include features to be incorporated into the final plans for the project and may also specify uses, activities, and operational measures that must be observed over the life of the project.

Continuous Simulation Modeling A method of hydrological analysis in which a set of rainfall data (typically hourly for 30 years or more) is used as input, and runoff rates are calculated on the same time step. The output is then analyzed statistically for the purposes of comparing runoff patterns under different conditions (for example, pre- and post-development-project).

Copermittees See **Dischargers**.

Detached Residential Development Any development that provides freestanding residential units. This category includes, but is not limited to: detached homes, such as single-family homes and detached condominiums.

Detention The practice of holding storm water runoff in ponds, vaults, within berms, or in depressed areas and letting it discharge slowly to the storm drain system. See definitions of **infiltration** and **retention**.

Direct Discharge Connection of project site runoff to an exempt receiving water body, which could include an exempt river reach, reservoir or lagoon. To qualify as a direct discharge, the discharge elevation from the project site outfall must be below the elevations detailed in the HMP Applicability section of this SUSMP Manual.

Directly Connected Impervious Area Any **impervious surface** which drains into a catch basin, area drain, or other conveyance structure without first allowing flow across pervious areas (e.g. lawns).

Direct Infiltration Infiltration via methods or devices, such as dry wells or infiltration trenches, designed to bypass unsaturated surface soils and transmit runoff directly to groundwater.

Dischargers The agencies named in the **storm water NPDES permit** (see definition): the County of San Diego; the Cities of Carlsbad, El Cajon, National City, Poway, Solana Beach, Chula Vista, Encinitas, Lemon Grove, San Diego, Vista, Coronado, Escondido, National City, San Marcos, Del Mar, Imperial Beach, Oceanside, and Santee; the San Diego Unified Port District, and the San Diego County Regional Airport Authority.

Drainage Management Areas Areas delineated on a map of the development site showing how drainage is detained, dispersed, or directed to **Integrated Management Practices**. There are four types of Drainage Management Areas, and specific criteria apply to each type of area. See Chapter 4.

Drawdown time The time required for a storm water detention or infiltration facility to drain and return to the dry-weather condition. For detention facilities, drawdown time is a function of basin volume and outlet orifice size. For infiltration facilities, drawdown time is a function of basin volume and infiltration rate.

Areas that include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance by the State Water Resources Control Board (Water Quality Control Plan for the San Diego Basin (1994) and amendments); water bodies designated with the RARE beneficial use by the State Water Resources Control Board (Water Quality Control Plan for the San Diego Basin (1994) and amendments); areas designated as preserves or their equivalent under the Multi Species Conservation Program within the Cities and County of San Diego; and any other equivalent environmentally sensitive areas which have been identified by the City of National City.

Environmentally Sensitive Areas

This **Priority Development Project** category includes all development and redevelopment located within or directly adjacent to or discharging directly to an environmentally sensitive area (where discharges from the development or redevelopment will enter receiving waters within the environmentally sensitive area), which either creates 2,500 square feet of impervious surface on a proposed project site or increases the area of imperviousness of a proposed project site to 10 percent or more of its naturally occurring condition. "Directly adjacent" means situated within 200 feet of the Environmentally Sensitive Area (ESA). "Discharging directly to "means outflow from a drainage conveyance system that is composed entirely of flows from the subject development or redevelopment site, and not commingled with flows from adjacent lands.

Flow Control

Control of runoff rates and durations as required by the Hydromodification Management Plan.

Head

In hydraulics, energy represented as a difference in elevation. In slow-flowing open systems, the difference in water surface elevation, e.g., between an inlet and outlet.

Higher-Rate Biofilter

A biofilter with a design surface loading rate higher than the 5 inches per hour rate specified in this document for bioretention facilities and planter boxes.

Hillside

Lands that have a natural gradient of 25 percent (4 feet of horizontal distance for every 1 foot of vertical distance) or greater and a minimum elevation differential of 50 feet, or a natural gradient of 200 percent (1 foot of horizontal distance for every 2 feet of vertical distance) or greater and a minimum elevation differential of 10 feet.

Hillside Development Greater Than 5,000 Square Feet

This Priority Development Project category includes any development which creates 5,000 square feet of **impervious surface** which is located in an area with known erosive soil conditions, where the development will grade any natural slope that is 25 percent or greater.

Hydrograph

Runoff flow rate plotted as a function of time.

Hydromodification

The change in the natural hydrologic processes and runoff characteristics (i.e. interception, infiltration, overland flow, interflow, and groundwater flow) caused by urbanization or other land use changes that result in increased stream flows and changes in sediment transport. In addition, alteration of stream and river channels, installation of dams and water impoundments, and excessive stream bank and shoreline erosion are also considered hydromodification, due to their disruption of natural watershed hydrologic processes.

Hydromodification Management Plan (HMP)
A Plan implemented by the **dischargers** so that post-project runoff shall not exceed estimated pre-project rates and/or durations, where increased runoff would result in increased potential for erosion or other adverse impacts to beneficial uses. Also see definition for **flow control**. Specifically, Regional HMP refers to the most recent Hydromodification Management Plan developed for San Diego County jurisdictions and approved by the San Diego RWQCB.

Hydrologic Soil Group
Classification of soils by the Natural Resources Conservation Service (NRCS) into A, B, C, and D groups according to infiltration capacity.

Industrial Development
Industrial facilities include those defined at 40 CFR 122.26(b)(14), including those subject to the General Industrial Permit or other individual NPDES permit, operating and closed landfills, facilities subject to SARA Title III, and hazardous waste treatment, disposal, storage and recovery facilities. Examples of industrial facilities includes manufacturing plants, food processing plants, metal working facilities, printing plants, and fleet storage areas (bus, truck, etc.). The **Priority Development Project** category includes development of heavy industry resulting in the disturbance of one acre or more of land.

Impervious surface
Any material that prevents or substantially reduces infiltration of water into the soil. See discussion of imperviousness in Chapter Two.

Infeasible
As applied to best management practices, impossible to implement because of technical constraints specific to the site.

Infiltration
Seepage of runoff into soils underlying the site. See definition of **retention.**

Infiltration Device
Any structure, such as a dry well, that is designed to infiltrate storm water into the subsurface and, as designed, bypasses the natural groundwater protection afforded by surface or near-surface soil. See definition for **direct infiltration**.

Integrated Management Practice (IMP)
A facility **(BMP)** that provides small-scale treatment, retention, and/or detention and is integrated into site layout, landscaping, and drainage design. See **Low Impact Development.**

Integrated Pest Management (IPM)
An approach to pest management that relies on information about the life cycles of pests and their interaction with the environment. Pest control methods are applied with the most economical means and with the least possible hazard to people, property, and the environment.

Jurisdictional Urban Runoff Management Plan (JURMP)
A written description of the specific jurisdictional urban runoff management measures and programs that the City of National City implements to comply with the **storm water NPDES permit** and ensure pollutant discharges are reduced to the MEP and do not cause or contribute to a violation of water quality standards. See **Storm Water Pollution Prevention Program.**

Lead Agency
The public agency that has the principal responsibility for carrying out or approving a project. (CEQA Guidelines §15367).

Low Impact Development An integrated site design methodology that uses small-scale detention and retention (Integrated Management Practices, or **IMPs**) to mimic pre-existing site hydrological conditions.

Maximum Extent Practicable (MEP) Standard, established by the 1987 amendments to the Clean Water Act, for the implementation of municipal **storm water pollution prevention programs** (see definition). According to the Act, municipal storm water NPDES permits "shall require controls to reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and system, design and engineering methods, and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants."

National Pollutant Discharge Elimination System (NPDES) As part of the 1972 Clean Water Act, Congress established the NPDES permitting system to regulate the discharge of pollutants from municipal sanitary sewers and industries. The NPDES was expanded in 1987 to incorporate permits for storm water discharges as well.

Natural Drainage A natural swale or topographic depression which gathers and/or conveys runoff to a permanent or intermittent watercourse or waterbody.

New Development Land disturbing activities; surface grading for structural development, including construction or installation of a building or structure, the creation of **impervious surfaces**; and land subdivision.

Numeric Criteria Sizing requirements for storm water treatment facilities established in Provision D.1.d.(6)(c) of the San Diego RWQCB's storm water NPDES permit.

Operation and Maintenance (O&M) Refers to requirements in the **Storm Water NPDES Permit** to inspect treatment BMPs and implement preventative and corrective maintenance in perpetuity. See Chapter Five.

Parking Lot A land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce. This **Priority Development Project** category includes parking lots 5,000 square feet or more or with 15 or more parking spaces and potentially exposed to urban runoff.

Permeable Pavements Pavements for roadways, sidewalks, or plazas that are designed to infiltrate a portion of rainfall, including pervious concrete, pervious asphalt, unit-pavers-on-sand, and crushed gravel.

Pollutant Generating Development Project Generally all projects which include **impervious surfaces** and/or introduce landscaping that requires routine use of fertilizers and pesticides are considered pollutant generating above background levels. Linear pathway projects that are for infrequent vehicle use, such as emergency or maintenance access, or for pedestrian or bicycle use, are not considered pollutant generating above background levels if they are built with pervious surfaces or if they sheet flow to surrounding pervious surfaces.

Priority Development Project A project subject to SUSMP requirements. Defined in **Storm Water NPDES Permit** Provision D.1.d.(1). See Appendix A.

Project Area	The entire project area comprises all areas to be altered or developed by the project, plus any additional areas that drain on to areas to be altered or developed.
Projects Discharging to Receiving Waters within Environmentally Sensitive Areas"	All development and significant redevelopment that would create 2,500 square feet of **impervious surfaces** or increase the area of imperviousness of a project site to 10% or more of its naturally occurring condition, and either (1) discharge urban runoff to a receiving water within or directly adjacent (where any portion of the project footprint is located within 200 feet of the **environmentally sensitive area**) to an environmentally sensitive area or (2) discharge to a receiving water within an environmentally sensitive area without mixing with flows from adjacent lands (where the **project footprint** is located more than 200 feet from the environmentally sensitive area).
Project Footprint	The limits of all grading and ground disturbance, including landscaping, associated with a project.
Project Submittal	Documents submitted to the City of National City in connection with an application for development approval and demonstrating compliance with Storm Water NPDES Permit requirements for the project
Proprietary	A proprietary device is one marketed under legal right of the manufacturer.
Receiving Waters	Surface bodies of water, which directly or indirectly receive discharges from urban runoff conveyance systems, including naturally occurring wetlands, streams (perennial, intermittent, and ephemeral [exhibiting bed, bank, and ordinary high water mark]), creeks, rivers, reservoirs, lakes, lagoons, estuaries, harbors, bays and the Pacific Ocean. National City will determine the definition for wetlands and the limits thereof for the purposes of this definition as protective as the United States Environmental Protection Agency. Constructed wetlands are not considered wetlands under this definition, unless the wetlands were constructed as mitigation for habitat loss. Other constructed **BMP**s are not considered receiving waters under this definition, unless the BMP was originally constructed in receiving waters. Construction of treatment control BMPs in "Receiving Waters" is prohibited and therefore may not be used to satisfy **SUSMP** requirements.
Redevelopment	The creation, addition, and or replacement of **impervious surface** on an already developed site. Examples include the expansion of a building footprint, road widening, the addition to or replacement of a structure, and creation or addition of impervious surfaces. Replacement of impervious surfaces includes any activity that is not part of a routine maintenance activity where impervious material(s) are removed, exposing underlying soil during construction. Redevelopment does not include trenching and resurfacing associated with utility work; resurfacing and reconfiguring surface parking lots and existing roadways; new sidewalk construction, pedestrian ramps, or bike lane on existing roads; and routine replacement of damaged pavement, such as pothole repair.
Rational Method	A method of calculating runoff flows based on rainfall intensity, tributary area, and a factor representing the proportion of rainfall that runs off.

Regional (or Watershed) Storm water Treatment Facility	A facility that treats runoff from more than one project or parcel.
Regional Water Quality Control Board (Regional Water Board or RWQCB)	California RWQCBs are responsible for implementing pollution control provisions of the Clean Water Act and California Water Code within their jurisdiction. There are nine California RWQCBs.
Residential Development	Any development on private land that provides living accommodations for one or more persons, including but not limited to: single-family homes, multi-family homes, condominiums, and apartments. This **Priority Development Category** is defined as housing subdivisions resulting in the disturbance of one acre or more of land or comprised of 10 or more dwelling units.
Residential Development of 10 Units or More	Any development that provides 10 or more residential units. Residential units can be attached or detached.
Restaurant	"Restaurant" means a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (**SIC** code 5812), where the land area for development is greater than 5,000 square feet. Restaurants where land development is less than 5,000 square feet shall meet all **SUSMP** requirements except for structural treatment BMP, numeric sizing criteria requirement, and hydromodification requirements.
Retail Gasoline Outlets (RGOs)	This **Priority Development Project** category includes RGOs that meet the following criteria: (a) 5,000 square feet or more, or (b) a projected average daily traffic (ADT) of 100 or more vehicles per day.
Retention	The practice of holding storm water in ponds or basins, or within berms or depressed areas, and allowing it to slowly infiltrate into underlying soils. Some portion will evaporate. See definitions for **infiltration** and **detention**.
Self-retaining area	An area designed to retain runoff. Self-retaining areas may include graded depressions with landscaping or pervious pavements and may also include tributary impervious areas up to a 2:1 impervious-to-pervious ratio.
Self-treating area	A natural, landscaped, or turf area drains directly off site or to the public storm drain system.
Significant Redevelopment	**Redevelopment** that would create or add or replace at least 5,000 square feet of **impervious surfaces** on an already developed site that falls under one or more priority development project categories. When redevelopment results in an increase of, or replacement of, 50% or more of the previously existing impervious surface, and the existing development was not subject to SUSMP requirements, then the entire project must be included in the treatment measure design. If less than 50% of the previously impervious surface is to be affected, only that portion must be included in the treatment measure design.

Source Control	Land use or site planning practices, or structural or nonstructural measures that aim to prevent urban runoff pollution by reducing the potential for contamination at the source of pollution. Source control BMPs minimize the contact between pollutants and urban runoff.
Standard Industrial Classification (SIC)	A Federal government system for classifying industries by 4-digit code. It is being supplanted by the North American Industrial Classification System but SIC codes are still referenced by the Regional Water Board in identifying development sites subject to regulation under the NPDES permit. Information and an SIC search function are available at http://www.bls.gov/bls/NAICS.htm
Storm Water NPDES Permit	A permit issued by a **Regional Water Quality Control Board** (see definition) to local government agencies (**Dischargers**) placing provisions on allowable discharges of municipal storm water to waters of the state.
Storm Water Pollution Prevention Plan (SWPPP)	A plan providing for temporary measures to control sediment and other pollutants during construction as required by the statewide storm water NPDES permit for construction activities. A SWPPP is required for projects causing land disturbance of one acre or more.
Storm Water Pollution Prevention Program	A comprehensive program of activities designed to minimize the quantity of pollutants entering storm drains. See **Jurisdictional Urban Runoff Management Plan.**
Standard Urban Storm Water Mitigation Plan (SUSMP)	Refers to various documents prepared in connection with implementation of the storm water **NPDES permit** mandate to control pollutants from new development and redevelopment. The City of National City has adopted this SUSMP Manual, adapted from the model countywide SUSMP. Applicants for development project approvals will use this SUSMP Manual to prepare a submittal for each **Priority Development Project** they propose.
Streets, Roads, Highways, and Freeways	This **Priority Development Project** category includes any paved surface that is 5,000 square feet or greater used for the transportation of automobiles, trucks, motorcycles, and other vehicles. For the purposes of SUSMP requirements, Streets, Roads, Highways and Freeways do not include trenching and resurfacing associated with utility work; applying asphalt overlay to existing pavement; new sidewalk, pedestrian ramps, or bike lane construction on existing roads; and replacement of damaged pavement.
Treatment	Removal of pollutants from runoff, typically by filtration or settling.
Treatment Control (Structural) BMP	Any engineered system designed and constructed to remove pollutants from urban runoff. Pollutant removal is achieved by simple gravity settling of particulate pollutants, filtration, biological uptake, media adsorption, or any other physical, biological, or chemical process.
Water Board	See **Regional Water Quality Control Board.**

Water Quality Volume (WQV)

For storm water treatment facilities that depend on detention to work, the volume of water that must be detained to achieve maximum extent practicable pollutant removal. This volume of water must be detained for a specified **drawdown time**.

Start

How to Use the Storm Water Best Management Practices Manual

Review Chapters 1 and 2 to get a general understanding of the requirements. Then follow step-by-step instructions in Chapter 3 to prepare your Project Submittal.

THIS Storm Water Best Management Practices Manual (SUSMP Manual) will help you ensure your project complies with the Local Standard Urban Storm Water Mitigation Plan (SUSMP) requirements of National City (City). Most applicants will require the assistance of a qualified civil engineer, architect, and/or landscape architect. Because every project is different, you should begin by checking specific requirements with City staff.

To use the SUSMP Manual, start by completing Appendix A to find out how storm water quality requirements apply to your project.

Chapter One provides an overview of the process of planning, design, construction, operation, and maintenance leading to compliance with post-construction SUSMP requirements.

If there are terms and issues you find confusing, try finding answers in the glossary or in **Chapter Two**. Chapter Two provides background on key storm water concepts and water quality regulations, including design criteria.

Then proceed to **Chapter Three** and follow the step-by-step guidance to prepare a Project Submittal for your site.

Chapter Four, the Low Impact Development Design Guide, includes design procedures, calculation procedures, and instructions for presenting your design and calculations in your Project Submittal.

In **Chapter Five** you'll find a detailed description of the process for ensuring operation and maintenance of your storm water facilities over the life of the project. The chapter includes step-by-step instructions for preparing a Storm Water Facilities Operation and Maintenance Plan.

Throughout each Chapter, you'll find references and resources to help you understand the regulations, complete your Project Submittal, and design storm water control measures for your project.

Construction-Phase Controls

Your Project Submittal for SUSMP compliance is a separate document from the Storm Water Pollution Prevention Plan (SWPPP). A SWPPP provides for temporary measures to control sediment and other pollutants during construction at sites that disturb one acre or more. See the Construction Handbook at www.cbmphandbooks.org for more information on SWPPPs.

The most recent, updated version of the SUSMP Manual is available electronically and is also available for purchase in hard copy from the City's Engineering Division. The electronic SUSMP Manual is in Adobe Acrobat format. If you are reading the Acrobat version on a computer with an internet connection, you can use hyperlinks to navigate the document and to access various references. The hyperlinks are throughout the text, as well as in "References and Resources" sections and in Appendix D. Some of these links (URLs) may be outdated. In that case, try entering portions of the title or other keywords into a web search engine.

► PLAN AHEAD TO AVOID THE THREE MOST COMMON MISTAKES

The most common (and costly) errors made by applicants for development approvals with respect to storm water quality compliance are:

1. Not planning for compliance early enough. You should think about your strategy for storm water quality compliance before completing a conceptual site design or sketching a layout of subdivision lots (Chapter 3).

2. Assuming proprietary storm water treatment facilities will be adequate for compliance. Most aren't (Chapter 2).

3. Not planning for periodic inspections and maintenance of treatment and flow-control facilities. Consider who will own and who will maintain the facilities in perpetuity and how they will obtain access, and identify which arrangements are acceptable to the City of National City (Chapter 5).

Chapter

1

Policies and Procedures

Determine if your development project must comply with storm water quality requirements, and review the steps to compliance.

Background

Urban runoff discharged from municipal storm water conveyance systems has been identified by local, regional, and national research programs as one of the principal causes of water quality problems in most urban areas. The City of National City's storm water conveyance system, which collects runoff from our streets, rooftops, driveways, parking lots, and other impervious areas, flows directly to our rivers, beaches, and bays without receiving treatment (our storm water conveyance system is separate from our sanitary sewer system). Urban runoff potentially contains a host of pollutants like trash and debris, bacteria and viruses, oil and grease, sediments, nutrients, metals, and toxic chemicals. These contaminants can adversely affect receiving and coastal waters, associated wildlife, and public health. Urban runoff pollution is not only a problem during rainy seasons, but also year-round due to many types of urban water use that discharge runoff (dry weather flow) to the storm water conveyance system.

Land development and construction activities significantly alter drainage patterns and contribute pollutants to urban runoff primarily through erosion and removal or change of existing natural vegetation during construction, and the creation of new impervious surfaces, such as parking lots, which often permanently contribute pollutants throughout the "use" of the project site. When homes, work places, recreational areas, roads, parking lots, and structures are built, new impervious areas are built- creating the potential for an impact to water quality. The natural landscape's ability to infiltrate and cleanse storm water and urban runoff is "capped" by the impervious surfaces. As impervious surfaces increase, water that normally would have percolated into the soil now flows over the land surface directly to downstream wetlands, creeks, and eventually the Pacific Ocean. Accordingly, increases in impervious cover can increase the frequency and intensity of storm water flows. Second, new impervious surfaces often become a source of pollutants associated with development, such as automotive fluids, cleaning solvents, toxic or hazardous chemicals, detergents, sediment, metals, pesticides, oil and grease, and food wastes. These pollutants, which are often temporarily captured on impervious surfaces, are transported to the storm water conveyance system by storm water and urban runoff. The pollutants flow untreated through the storm water conveyance system and ultimately into our creeks, rivers, beaches, and bays. With the growing concerns of urban runoff and storm water pollution, local, state, and federal agencies devised regulations requiring development planning and construction controls to treat storm water-related pollution from new development projects before it reaches any receiving waters.

On February 21, 2001, the San Diego Regional Water Quality Control Board (Regional Board) issued the Municipal Storm Water National Pollutant Discharge Elimination System (NPDES) Permit (Order No. 2001-01), to the City of National City, the County of San Diego, the Port of San Diego, and 16 other cities in the region. This order required the development and implementation of storm water regulations addressing storm water pollution issues in development planning and construction associated with private and public development projects. In order to comply with the conditions of Order No. 2001-01, the City of National City adopted the National City Storm Water Management and Discharge Control Ordinance ("Storm Water Ordinance") codified in Chapter 14.22.010 of the National City Municipal Code.

On January 24th, 2007, the Regional Board issued Order No. R9-2007-0001 (NPDES Permit). This NPDES Permit replaces the previous municipal permit, RWQCB Order No. 2001-01. The City's Storm Water Ordinance has been updated as necessary to comply with the current NPDES Permit. This manual is adopted by reference as The City of National City Standard Urban Storm Water Management Plan (SUSMP) Manual, herein referred to as the SUSMP Manual. To maximize the use of LID practices as a means of reducing storm water runoff, Order No. R9-2007-0001 further required that the City define minimum LID and other BMP requirements in a document called the Model Standard Urban Storm Water Mitigation Plan (Model SUSMP), which was approved by the Regional Board on March 25, 2009. The permanent BMP requirements within the Model SUSMP were updated to comply with the current NPDES Permit, and these changes are included in this SUSMP Manual.

Legal Framework

The requirement to implement storm water BMP requirements for development projects is based on Section 402 (p) of the Clean Water Act. The Federal Clean Water Act amendments of 1987 established a framework for regulating storm water discharges from municipal, industrial, and construction activities under the NPDES program. Under the Federal Clean Water Act, municipalities throughout the nation are issued a Municipal NPDES Permit. The primary goal of the NPDES Permit is to stop polluted discharges from entering the storm water conveyance system and local receiving and coastal waters.

In California, the State Water Resources Control Board (SWRCB), through the nine Regional Boards, administers the NPDES storm water municipal permitting program. Based on the San Diego Municipal Permit issued by the San Diego Regional Board, the City is required to develop and implement construction and permanent storm water BMPs addressing pollution from new development projects.

These ordinances have been updated as necessary to comply with the current NPDES Municipal Permit. The current NPDES Municipal Permit requires the City to categorize and prioritize land uses in order to establish effective BMPs. The City's current Storm Water Ordinance authorizes the City of National City to establish Best Management Practices (BMPs), including permanent improvements, for all types of land uses.

The City of National City may establish alternative BMPs. The allowable use of alternative BMPs at a specific site shall be determined at the sole discretion of the City. The City may establish BMPs for a specific site or activity if necessary to reduce Pollutants to the MEP or to comply with an order of the San Diego Regional Water Board. The City may also establish additional BMPs for a specific site if the City determines that the BMPs implemented at the site have not reduced the pollutants to the MEP**.**

A Low Impact Development Design Procedure

The San Diego Regional Water Board reissued a municipal storm water NPDES permit to the municipal **Copermittees** in January 2007. The permit updates and expands storm water requirements for new developments and redevelopments. Storm water treatment requirements have been made more stringent, minimum standards for **Low Impact Development** (LID) have been added, and the Copermittees are required to develop and implement criteria for the control of runoff peaks and durations from development sites.

To assist the land development community, streamline project reviews, and maximize cost-effective environmental benefits, the Copermittees have developed a unified LID design procedure, which has been adapted for use by the City of National City. This design procedure integrates site planning and design measures with engineered, small-scale **Integrated Management Practices** (IMPs) such as bioretention. By following the procedure, applicants can develop a single integrated design which complies with the complex and overlapping NPDES permit LID requirements, storm water treatment requirements, and flow-control (hydromodification management) requirements.

The design approach is detailed in Chapter 4. General instructions for preparing a complete Project Submittal are in Chapter 3, and project-specific submittal requirements are available from City staff.

Applicants may choose not to use this design procedure, in which case they will need to demonstrate, in their submittal, compliance with applicable LID criteria, storm water treatment criteria, and flow-control criteria. These criteria are described in Chapter 2, the City's Storm Water Ordinance (Chapter 14.22.010), and in the NPDES permit.

Requirements for All Development Projects

All development projects must include control measures to reduce the discharge of storm water pollutants to the maximum extent practicable.

Standard permanent storm water requirements, even for projects that are not "Priority Development Projects," include:

- Implementation of source control BMPs as listed in Appendix C.
- Inclusion of feasible LID features that conserve natural features, set back development from natural water bodies, minimize imperviousness, maximize infiltration, direct runoff to landscaping, and retain and slow runoff.
- Submittal of proof of a mechanism under which on-going long-term maintenance of all structural post-construction BMPs will be conducted.

See Chapter 14.22.160 of the City's Municipal Code for a list of BMP requirements applicable to all development projects.

City staff may also require additional controls appropriate to the project, which may include storm water treatment controls. LID treatment controls such as infiltration or bioretention are preferred. See "Selection of Treatment Facilities" on page 38.

Priority Development Projects

The NPDES permit requires more specific criteria be applied to Priority Development Projects. Projects (requiring either discretionary actions or construction permits), subject to the priority development project permanent BMP requirements (as determined by completing Appendix A) must complete all of the analyses and incorporate all of the applicable BMP requirements in chapters 2 through 5 of this SUSMP Manual. This includes the LID and source control BMPs, and treatment control BMP requirements.

Projects subject to priority development project requirements must prepare and submit a Project Submittal in accordance with Chapter 3 of this SUSMP Manual. Applicants must incorporate all necessary permanent BMPs into the project plans prior to submittal, regardless of project type.

► NEW DEVELOPMENT

Projects on previously undeveloped land are Priority Development Projects if they are in one or more of the categories listed in Appendix A. If a project feature such as a parking lot falls into a Priority Development Project category, then the entire project footprint is subject to Priority Development Project requirements. Note some Priority Development Project category thresholds are defined by square footage of impervious area created; others by the total area of the development.

► PREVIOUSLY DEVELOPED SITES

Projects on previously developed sites ("**redevelopment** projects") are Priority Development Projects if they create, add, or replace 5,000 square feet or more of impervious surface and also are in one of the categories listed in Appendix A.

City staff may choose to designate projects not within the categories in Appendix A as Priority Development Projects, based on potential impacts to storm water quality.

► THE "50% RULE" FOR PREVIOUSLY DEVELOPED PROJECTS

Projects on previously developed sites may also need to retrofit drainage of **all** impervious areas of the **entire** site. For sites creating or replacing more than 5,000 square feet of impervious area:

- If the new project results in an increase of, or replacement of, 50% or more of the previously existing impervious surface, and the existing development was not subject to SUSMP requirements, then the entire project must be included in the treatment measure design.
- If less than 50% of the previously impervious surface is to be affected, only that portion must be included in the treatment measure design.

If a Redevelopment Project feature such as a parking lot falls into a Priority Development Project category, then the entire project footprint is subject to SUSMP requirements.

Projects limited to interior remodels, routine maintenance or repair, roof or exterior surface replacement, resurfacing and reconfiguring surface parking lots and existing roadways, new sidewalk construction, pedestrian ramps, or bike lanes on existing roads and routine replacement of damaged pavement such as pothole repair are not subject to treatment requirements. However, other requirements, including incorporation of appropriate source controls, still apply.

► POLLUTANT GENERATING PROJECTS WHICH DISTRUB ONE ACRE OR MORE OF LAND

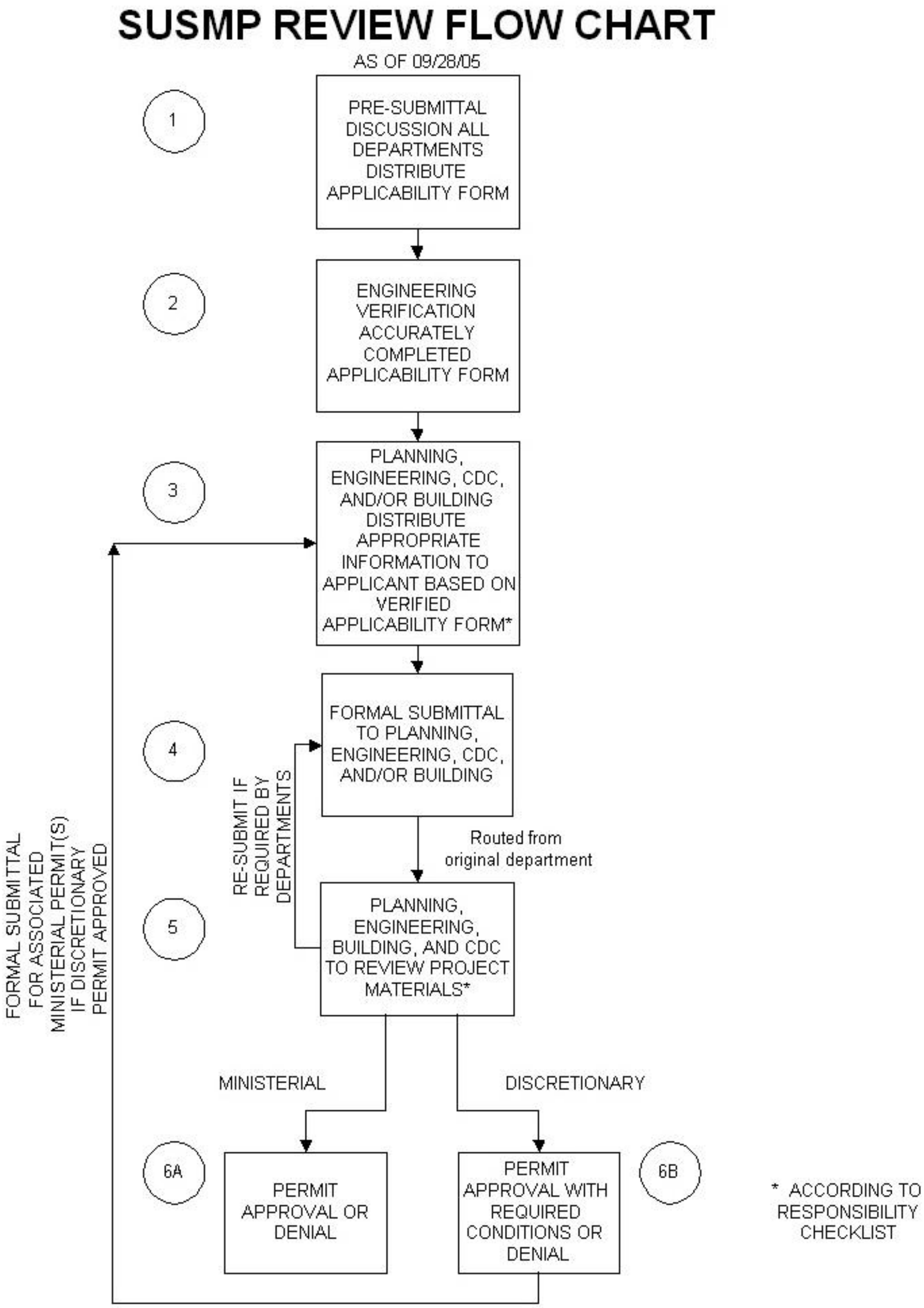
Projects that generate pollutants at levels greater than background levels and disturb one acre or more of land are considered Priority Development Projects. In most cases linear pathway projects that are for infrequent vehicle use (such as emergency or maintenance access) or for pedestrian or bicycle use are not considered pollutant generating above background levels if they are built with pervious surfaces or if they allow runoff to sheet flow to surrounding pervious surfaces.

Project Review and Permitting Process

The City of National City's Storm Water Ordinance requires that all new development and redevelopment activities comply with the storm water pollution prevention requirements in Chapter 14.22.010 of the National City Municipal Code, and this SUSMP Manual. These storm water pollution prevention requirements, which are described in detail in this SUSMP Manual are site specific and vary based on the project's potential impact on receiving water quality.

The flow chart in Figure 1-1, "Review Process for Discretionary Actions" demonstrates how storm water requirements are incorporated into projects requiring subdivision approvals, development permits or other discretionary actions. The steps below in "Compliance Process at a Glance" describe the elements of the plan review and permitting processes for storm water best management practice (BMP) requirements.

FIGURE 1-1. SUSMP Review Flow Chart



Compliance Process at a Glance

For the applicant for development project approval, storm water compliance follows these general steps:

1. Discuss requirements during a pre-application meeting with City staff.
2. Determine applicable storm water BMP requirements by completing the "National Pollutant Discharge Elimination System (NPDES) Project Applicability Form" in Appendix A prior to submittal.
3. Review the instructions in this SUSMP Manual before you prepare your tentative map, preliminary site plan, drainage plan, and landscaping plan.
4. Prepare your Project Submittal, which is typically made with your application for development approvals (entitlements).
5. Include a Storm Water Facility Operation and Maintenance Plan with your Project Submittal.
6. Under the authority of the City of National City, Engineering staff will review the Project Submittal with Storm Water Facility Operation and Maintenance Plan for compliance with the applicable storm water requirements contained in this SUSMP Manual.
7. Create your detailed project design, incorporating the features described in your Project Submittal.
8. In a table on your construction plans, list each storm water compliance feature and facility and the plan sheet where it appears.
9. Maintain storm water facilities during construction and following construction in accordance with required warranties.
10. Following construction, make any necessary changes to the Storm Water Facility Operation and Maintenance Plan, and provide it to the owner or other party responsible for maintenance.
11. The owner must periodically verify storm water facilities are properly maintained.

Preparation of a complete and detailed Project Submittal is the key to cost-effective storm water compliance and expeditious review of your project. Additional notes about these steps are provided below. Instructions for preparing your Project Submittal are in Chapter 3.

► ADDITIONAL NOTES ON COMPLIANCE

Storm Water Requirements Applicability Checklist. Prior to submittal, applicants must complete the "National Pollutant Discharge Elimination System (NPDES) Project Applicability Form" (Applicability Checklist) in Appendix A, to determine if their project is subject to construction and/or permanent storm water best management practice (BMP) requirements. (Note: this form must be completed for all permit applications, even if previous approvals exist. Projects requesting additional construction permits or discretionary approvals, even though previous permits and/or approvals have been obtained, will be required to comply with the storm water requirements in this document). This checklist must be completed, signed by the responsible party for the project, and submitted with your permit application. Applicants may also verify the project's storm water BMP requirements through a single discipline preliminary review of the project. The project design must include all required permanent BMPs (as determined from the Applicability Checklist in Appendix A), prior to deeming the application package complete.

Determining Adequacy of Proposed Plans. The City of National City may approve proposed alternatives to the BMP requirements in this manual if they are determined to be applicable and equally effective. Additional analysis or information may be required to enable staff to determine the adequacy of proposed BMPs.

Phased Projects

When determining whether SUSMP requirements apply, a "project" should be defined consistent with California Environmental Quality Act (CEQA) definitions of "project." That is, the "project" is the whole of an action which has the potential for adding or replacing or resulting in the addition or replacement of roofs, pavement, or other impervious surfaces and thereby resulting in increased flows and storm water pollutants. "Whole of an action" means the project may not be segmented or piecemealed into small parts if the effect is to reduce the quantity of impervious area for any part to below the SUSMP thresholds.

City staff may require, as part of an application for approval of a phased development project, a conceptual or master Project Submittal which describes and illustrates, in broad outline, how the drainage for the project will comply with the SUSMP requirements. The level of detail in the conceptual or master Project Submittal should be consistent with the scope and level of detail of the development approval being considered. The conceptual or master Project Submittal should specify that a more detailed Project Submittal for each later phase or portion of the project will be submitted with subsequent applications for discretionary approvals.

Note these minimum standards for SUSMP applicability are for the purpose of ensuring a consistent minimum level or "floor" for implementation consistent with the requirements of the NPDES permit. The City of National City reserves the right to choose a more expansive interpretation of the NPDES permit's applicability and may also choose to apply source control, treatment, and flow-control requirements to projects that would be exempt under these minimum standards.

New Subdivisions

If a tentative map approval would potentially entitle future owners to construct new or replaced impervious area which, in aggregate, could exceed one of the SUSMP thresholds (Appendix A), then the applicant must take steps to ensure SUSMP requirements can and will be implemented as the subdivision is built out.

If the tentative map application does not include plans for site improvements, the applicant should nevertheless identify the type, size, location, and final ownership of storm water treatment and flow-control facilities adequate to serve common private roadways and any other common areas, and to also manage runoff from an expected reasonable estimate of the square footage of future roofs, driveways, and other impervious surfaces on each individual lot. The City of National City may condition approval of the map on implementation of storm water treatment and other SUSMP measures when construction occurs on the individual lots. At the City of National City's discretion, this condition may be enforced by a grant deed of development rights or by a development agreement.

If the City of National City deems it necessary, the future impervious area of one or more lots may be limited by a deed restriction. This might be necessary when a project is exempted from one or all SUSMP provisions because the total impervious area is below a threshold, or to ensure runoff from impervious areas added after the project is approved does not overload a storm water treatment and flow-control facility.

The City of National City may require subdivision maps to dedicate an "open space easement, as defined by Government Code Section 51075," to suitably restrict the future building of structures at each storm water facility location if necessary.

In general, in new subdivisions **storm water treatment, infiltration, or flow-control facilities should not be located on individual single-family residential lots**, particularly when those facilities manage runoff from other lots, from streets, or from common areas. A better alternative is to locate storm water facilities on one or more separate, jointly owned parcels.

After consulting with local planning staff, applicants for subdivision approvals will propose one of the following four options, depending on project characteristics and local policies:

1. Show the number of parcels and the total impervious area to be created on all parcels could not, in the future, exceed any of the thresholds in Appendix A.

2. Show that, for each and every lot, the intended use can be achieved with a design which disperses runoff from roofs, driveways, streets, and other impervious areas to self-retaining pervious areas, using the criteria in Chapter 4.

3. Prepare improvement plans showing drainage to treatment and/or flow-control facilities designed in accordance with this BMP manual, and commit to constructing the facilities prior to transferring the lots.

4. Prepare improvement plans showing drainage to treatment and/or flow-control facilities designed in accordance with this BMP manual, and provide appropriate legal instruments to ensure the proposed facilities will be constructed and maintained by subsequent owners.

For the option selected, City staff will determine the appropriate conditions of approval, easements, deed restrictions, or other legal instruments necessary to assure future compliance.

Compliance with Flow-Control Requirements

Priority Development Projects (Appendix A) must be designed so that runoff rates and durations are controlled to maintain or reduce pre-project downstream erosion conditions and protect stream habitat. The following text regarding HMP applicability requirements is based on the HMP document, provided in Appendix E.

► HMP APPLICABILITY REQUIREMENTS

To determine if a proposed project must implement hydromodification controls, refer to the HMP Decision Matrix in Figure 1-2. The HMP Decision Matrix can be used for all projects. For redevelopment projects, flow controls would only be required if the redevelopment project increases impervious area or peak flow rates as compared to pre-project conditions.

It should be noted that all Priority Development Projects will be subject to the Permit's LID and water quality treatment requirements even if hydromodification flow controls are not required.

As noted in Figure 1-2, projects may be exempt from HMP criteria under the following conditions.

- If the project is not a Priority Development Project
- If the proposed project does not increase the impervious area or peak flows to any discharge location.
- If the proposed project discharges runoff directly to an exempt receiving water such as the Pacific Ocean, San Diego Bay, an exempt river reach, an exempt reservoir, or a tidally-influenced area.
- If the proposed project discharges to a stabilized conveyance system that extends to the Pacific Ocean, San Diego Bay, a tidally-influenced area, an exempt river reach or reservoir.
- If the contributing watershed area to which the project discharges has an impervious area percentage greater than 70 percent
- If an urban infill project discharges to an existing hardened or rehabilitated conveyance system that extends beyond the "domain of analysis," the potential for cumulative impacts in the watershed are low, and the ultimate receiving channel has a Low susceptibility to erosion as defined in the SCCWRP channel assessment tool.

If the proposed project decreases the pre-project impervious area and peak flows to each discharge location, then a flow-duration analysis is implicitly not required. If continuous simulation flow-frequency and flow duration curves were developed for such a scenario, the unmitigated post-project flows and durations would be less as compared to pre-project curves.

Proposed exemptions for projects discharging runoff directly to the Pacific Ocean, San Diego Bay or to hardened conveyance systems which transport runoff directly to the Pacific Ocean or San Diego Bay are referred to the 2007 Municipal Permit. Per the Permit, hardened conveyance systems can include existing concrete channels, storm drain systems, etc.

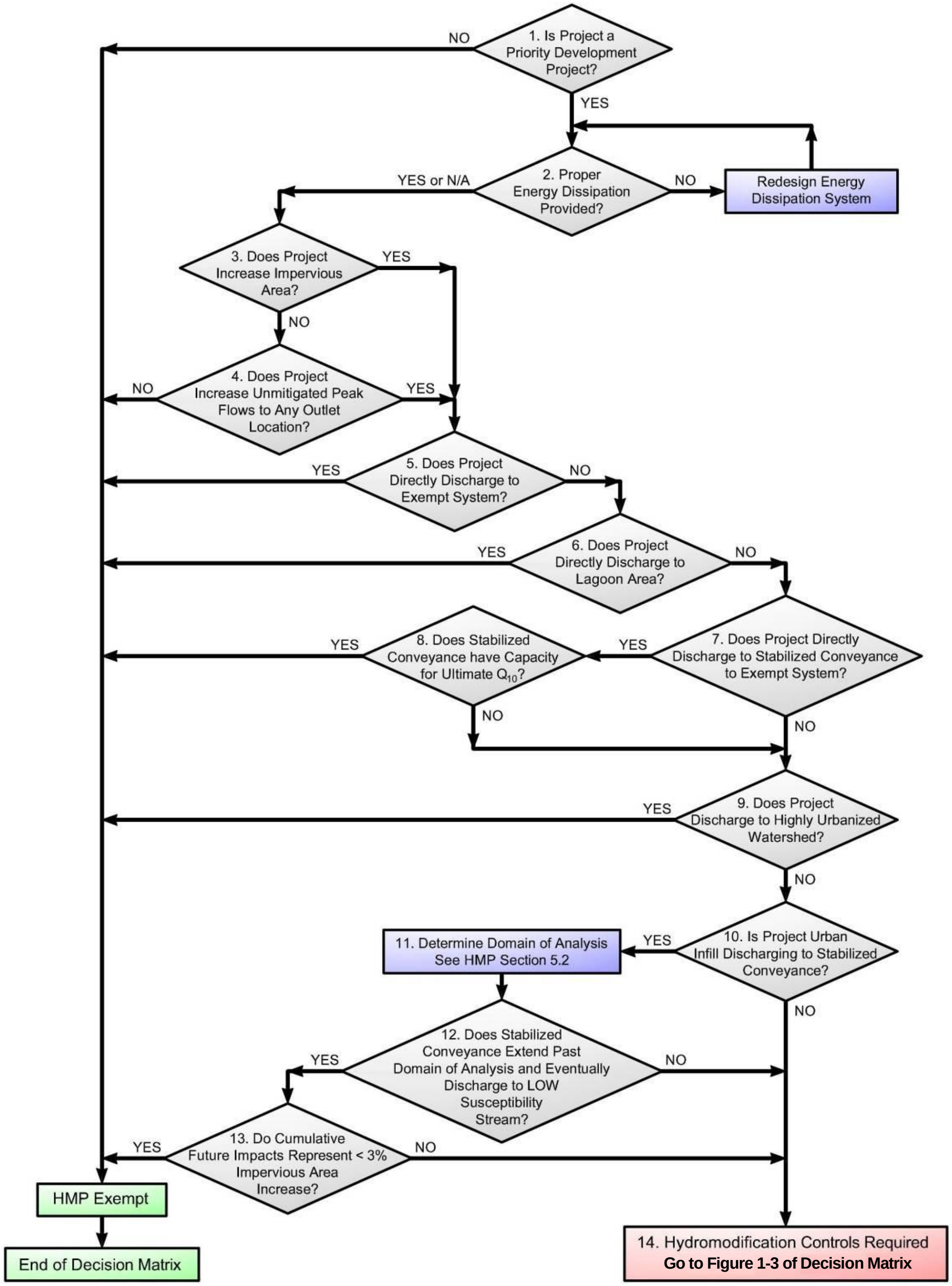


FIGURE 1-2. HMP Applicability Determination

The Municipal Permit also contains language to support exemptions for projects located in highly urbanized areas where the impervious percentage exceeds 70 percent (as calculated for the sub-watershed between the project outfall downstream to the exempt receiving water).

- Figure 1-2, Node 1 – Hydromodification mitigation measures are only required if the proposed project is a Priority Development Project.
- Figure 1-2, Node 2 – Properly designed energy dissipation systems are required for all project outfalls to unlined channels. Such systems should be designed in accordance with the County of San Diego's Drainage Design Manual to ensure downstream channel protection from concentrated outfalls.
- Figure 1-2, Nodes 3 and 4 – Projects may be exempt from hydromodification criteria if the proposed project reduces the pre-project impervious area and if unmitigated post-project outflows (outflows without detention routing) to each outlet location are less as compared to the pre-project condition. The pre and post-project hydrologic analysis should be conducted for the 2 and 10-year design storms and follow single-event methodology set forth in the San Diego Hydrology Manual. This scenario may apply to redevelopment projects in particular.
- Figure 1-2, Node 5 – Potential exemptions may be granted for projects discharging runoff directly to an exempt receiving water, such as the Pacific Ocean, San Diego Bay, an exempt river system (detailed in Table 1-2), or an exempt reservoir system (detailed in Table 1-2). To qualify for this exemption, projects must discharge runoff at an elevation, to be determined by the City, below the 10-year floodplain elevation for a river exemption or below the typical water surface level in a reservoir system. The City may grant, on a case-by-case basis, additional exemptions for projects discharging runoff in the immediate vicinity of exempt river or reservoir systems provided that a stabilized, natural conveyance (non-hardened) is provided between the project discharge location and exempt river or reservoir water surface elevation.
- Figure 1-2, Node 6 – For projects discharging runoff directly to a tidally-influenced lagoon, potential exemptions may also be granted. To qualify for this exemption, projects must discharge runoff at an elevation, to be determined by the City, below the typical water surface level in the lagoon system (such as the mean high tide elevation). The City may grant, on a case-by-case basis, additional exemptions for projects discharging runoff in the immediate vicinity of lagoon systems provided that a stabilized, natural conveyance (non-hardened) is provided between the project discharge location and typical lagoon water surface elevation. Exemptions related to runoff discharging directly to tidally-influenced areas were drafted based upon precedent set in the Santa Clara HMP. Regarding the potential exemption, additional analysis would be required to assess the effects of the freshwater / saltwater balance and the resultant effects on lagoon-system biology. This assessment, which would be required by other permitting processes such as the Army Corps of Engineers, California Department of Fish and Game, etc., must be provided by a certified biologist or other specialist as approved by the City. Such discharges would include an energy dissipation system

(riprap, etc.) designed to mitigate 100-year outlet velocities based upon a free outfall condition. Such a design would be protective of the channel bed and bank from an erosion standpoint.

- Figure 1-2, Nodes 7 and 8 – For projects discharging runoff directly to a hardened conveyance or rehabilitated stream system that extends to exempt receiving waters detailed in Node 5, potential exemptions from hydromodification criteria may be granted. Such hardened or rehabilitated systems could include existing storm drain systems, existing concrete channels, or stable engineered unlined channels. To qualify for this exemption, the existing hardened or rehabilitated conveyance system must continue uninterrupted to the exempt system. In other words, the hardened or rehabilitated conveyance system cannot discharge to an unlined, non-engineered channel segment prior to discharge to the exempt system. Additionally, the project proponent must demonstrate that the hardened or rehabilitated conveyance system has capacity to convey the 10-year ultimate condition flow through the conveyance system. The 10-year flow should be calculated based upon single-event hydrologic criteria as detailed in the San Diego County Hydrology Manual.

- Figure 1-2, Node 9 – As allowed per the Municipal Permit, projects discharging runoff to a highly urbanized watershed (defined as an existing, pre-project impervious percentage greater than 70 percent) may be eligible for an exemption from hydromodification criteria.

  Watershed impervious area calculations for this potential exemption will be measured between the project site discharge location and the connection to a downstream exempt receiving conveyance system, such as the Pacific Ocean, San Diego Bay, or an exempt river system. If a tributary area connects with the main line drainage path between the project site and the exempt system, then the entire watershed area contributing to the tributary shall be included in the calculation. Initial review of County land use indicates that this exemption will likely only apply in a limited number of urbanized coastal areas.

  Percent imperviousness will be calculated based on an area-weighted average of impervious areas associated with commercial, industrial, single-family residential, multi-family residential, open space, and other miscellaneous areas (schools, churches, etc.) representative for the watershed. Representative percent imperviousness values for each land use type may correspond to values recommended in Table 3-1 of the County of San Diego's Hydrology Manual and detailed below or by more specific representative percent impervious calculations (using GIS, etc.), which are often required to represent impervious area percentages for park, school and church sites.

- Figure 1-2, Nodes 10 through 13 – For urban infill projects discharging runoff to an existing hardened or rehabilitated conveyance system, potential limited exemptions from hydromodification criteria may apply where the existing impervious area percentage in the watershed exceeds 40 percent. For the potential exemption application, the domain of analysis must be determined and the existing hardened or rehabilitated conveyance system must extend beyond the downstream terminus of the domain of analysis. The hardened or rehabilitated conveyance system must discharge to a receiving channel with a Low potential for channel susceptibility for this exemption to be granted (channel susceptibility determined using SCCWRP tool). Finally, continuous simulation sensitivity analysis shows that an exemption could only be granted if the potential future development impacts in the watershed would increase the watershed's impervious area percentage by less than 3 percent (as compared to the existing condition in the year 2010). If the potential future cumulative impacts in the watershed could increase the impervious area percentage by more than 3 percent (as compared to existing condition), then no exemption could be granted based on this item. Watershed impervious area calculations for this potential exemption, in which a project discharges to a watershed with an existing impervious areas greater than 40 percent, will be measured upstream from the outfall of the urban conveyance system (to a non-concrete, non-riprap-lined or non-engineered channel) to the contributing watershed boundary (the entire watershed contributing to the discharge outfall).

  Percent imperviousness will be calculated based on an area-weighted average of impervious areas associated with commercial, industrial, single-family residential, multi-family residential, open space, and other miscellaneous areas (schools, churches, etc.) representative for the watershed. Representative percent imperviousness values for each land use type may correspond to values recommended in Table 3-1 of the County of San Diego's Hydrology Manual and detailed below or by more specific representative percent impervious calculations (using GIS, etc.), which are often required to represent impervious area percentages for park, school and church sites.

Exemptions related to runoff discharging directly to certain river reaches were initially based upon the majority Technical Advisory Committee (TAC) opinion that such river reaches were depositional (aggrading) and that the effects of cumulative watershed impacts to these reaches is minimal. Subsequent justifications for the river reach exemptions were the result of a flow duration curve analysis for the San Diego River

Potential river reaches that would be exempt from hydromodification criteria include only those reaches for which the contributing drainage area exceeds 100 square miles and which have a 100-year design flow in excess of 20,000 cfs. For reference, proposed Caltrans HMP criteria allows for river/creek exemptions for drainage areas of only 10 square miles.

Per recommendations from members of the TAC, San Diego river systems meeting the drainage area and peak flow criteria are typically aggrading (depositional) and have very wide floodplain areas when in the natural condition. In all cases, river reaches meeting the drainage area and peak flow criteria are located downstream of large reservoir systems which effectively block outflows for most storm events. In addition, the river systems meeting these criteria typically have very low gradients. The combination of low gradients, significant peak flow attenuation, and wide floodplain areas translate to a low potential for channel erosion at the upper limit of the proposed geomorphic flow range (10-year flow event).

All exempt river reaches, which are presented in Table 1-1, have drainage areas in excess of 100 square miles and 100-year flow rates in excess of 20,000 cfs. In addition, all proposed river reaches are subject to significant upstream reservoir flow regulation, have wide floodplain or stabilized channel areas, and low gradients. This combination of factors, in association with field observations and years of historical perspective from the TAC members, justifies exemptions for direct discharges to the exempt river reaches provided that properly sized energy dissipation is provided at the outfall location.

TABLE 1-1. Summary of Exempt River Reaches in San Diego County

River	Downstream Limit	Upstream Limit
Otay River	Outfall to San Diego Bay	Lower Otay Reservoir Dam
San Diego River	Outfall to Pacific Ocean	Confluence with San Vicente Creek
San Dieguito River	Outfall to Pacific Ocean	Lake Hodges Dam
San Luis Rey River	Outfall to Pacific Ocean	Upstream river limit of Basin Plan subwatershed 903.1 upstream of Bonsall and near Interstate 15
Sweetwater River	Outfall to San Diego Bay	Sweetwater Reservoir Dam

Table 1-2 provides a summary of exempt reservoirs in San Diego County. Large reservoirs can be exempt systems from a hydromodification standpoint since reservoir storm water inflow velocities are naturally mitigated by the significant tailwater condition in the reservoir. HMP exemptions would only be granted for projects discharging runoff directly to the exempt reservoirs. The City will define “direct discharge” based on the project site conditions. To qualify for the potential exemption, the outlet elevation must be at or below either the normal operating water surface elevation or the reservoir spillway elevation and properly designed energy dissipation must be provided.

TABLE 1-2. Summary of Exempt Reservoirs in San Diego County

Reservoir	Watershed
Barrett Lake	Tijuana River
El Capitain Reservoir	San Diego River
Lake Dixon	Escondido Creek
Lake Heneshaw	San Luis Rey River
Lake Hodges	San Dieguito River
Lake Jennings	San Diego River
Lake Murray	San Diego River
Lake Poway	San Dieguito River
Lake San Marcos	San Marcos Creek
Lake Wohlford	Escondido Creek
Loveland Reservoir	Sweetwater River
Lower Otay Reservoir	Otay River
Miramar Lake	Los Penasquitos Creek
San Vicente Reservoir	San Diego River
Sweetwater Reservoir	Sweetwater River
Upper Otay Reservoir	Otay River

The final exemption category focuses on small urban infill projects where the potential for future cumulative watershed impacts is minimal.

Urban infill projects may be exempt from HMP criteria if:

1. The potential future development impacts within the sub-watershed, as measured from the entire sub-watershed area draining to the existing conveyance system outfall, would not increase the composite impervious area percentage of the sub-watershed by more than 3 percent

2. The project discharges runoff to an existing hardened or rehabilitated conveyance system (storm drain, concrete channel, or engineered vegetated channel) that extends beyond the Domain of Analysis determined for the project site, and

3. The stabilized conveyance system eventually discharges to a channel with a Low susceptibility to erosion, as designed by the SCCWRP channel assessment tool.

► FLOW CONTROL PERFORMANCE CRITERIA

Figures 1-2 and 1-3, which are part of the HMP Decision Matrix, detail how lower flow thresholds would be determined for a project site. Figures 1-4 and 1-5, which detail the SCCWRP lateral and vertical channel susceptibility requirements, complete the HMP Decision Matrix.

The project applicant must first determine whether field investigations will be conducted pursuant to the SCCWRP channel screening tools. If the screening tools are not completed for a proposed project, then the site must mitigate peak flows and durations based on a pre-project condition lower flow threshold of $0.1Q_2$. While a project applicant would be held to the $0.1Q_2$ standard if channel screening tools and assessments are not conducted, less restrictive standards are possible for more erosion-resistant receiving channel sections if the screening tools are completed and the SCCWRP method indicates either a Medium or Low susceptibility to channel erosion .

In such a scenario, the project applicant would also use the critical shear stress calculator to assist in determination of the predicted lower flow threshold. The SCCWRP screening tools and critical shear stress calculator work in concert to determine the lower flow threshold for a given site. Lower flow limits determined by the calculator have been grouped into one of three thresholds – $0.1Q_2$, $0.3Q_2$ or $0.5Q_2$. "Low" susceptibilities from the SCCWRP tool generally correspond to the $0.5Q_2$ threshold, "Medium" susceptibilities generally correspond to the $0.3Q_2$ threshold, and "High" susceptibilities generally correspond to the $0.1Q_2$ threshold. The SCCWRP channel screening tools are required to identify channel conditions not considered by the critical shear stress calculator, which focuses on channel material and cross section. Conversely, the SCCWRP channel screening tools considers other channel conditions including channel braiding, mass wasting, and proximity to the erosion threshold. In cases where the critical shear stress calculator and the SCCWRP screening tools return divergent values, then the most conservative value shall be used as the lower flow threshold for the analysis.

Low-Impact Development (LID) and extended detention facilities are required to meet peak flow and duration controls as follows:

4. For flow rates ranging from 10 percent, 30 percent or 50 percent of the pre-project 2-year runoff event ($0.1Q_2$, $0.3Q_2$, or $0.5Q_2$) to the pre-project 10-year runoff event (Q10), the post-project discharge rates and durations shall not deviate above the pre-project rates and durations by more than 10 percent over and more than 10 percent of the length of the flow duration curve. The specific lower flow threshold will depend on results from the SCCWRP channel screening study and the critical flow calculator.

5. For flow rates ranging from the lower flow threshold to Q_5, the post-project peak flows shall not exceed pre-project peak flows. For flow rates from Q_5 to Q_{10}, post-project peak flows may exceed pre-project flows by up to 10 percent for a 1-year frequency interval. For example, post-project flows could exceed pre-project flows by up to 10 percent for the interval from Q_9 to Q_{10} or from $Q_{5.5}$ to $Q_{6.5}$, but not from Q_8 to Q_{10}.

This HMP recommends the use of LID facilities to satisfy both 85th percentile water quality treatment as well as HMP flow control criteria. Detailed standards for LID implementation have been developed. These standards are provided in the City of National City SUSMP Manual.

The following methods may be used to meet mitigation requirements.

- Install BMPs that meet design requirements to control runoff from new impervious areas. BMPs including bioretention basins, vegetated swales, planter boxes, extended detention basins, etc. shall be designed pursuant to standard sizing and specification criteria detailed in the City of National City SUSMP Manual and the HMP/LID Sizing Calculator to ensure compliance with hydromodification criteria.

- Use of the automated sizing calculator (San Diego Sizing Calculator) that will allow project applicants to select and size LID treatment devices or flow control basins. The tool, akin to the sizing calculator developed for compliance with the Contra Costa HMP, uses pre-calculated sizing factors to determine required footprint sizes for flow control BMPs. Continuous simulation hydrologic analyses are currently being developed to determine the sizing factors for various flow control options and development scenarios. The Sizing Calculator also includes an automated pond sizing tool to assist in the design of extended detention facilities for mitigation of hydromodification effects. Because of the Sizing Calculator's ease of implementation, and since hydromodification BMPs can also serve as treatment BMPs, it is anticipated that most project applicants will choose this option instead of seeking compliance through site-specific continuous simulation model preparation. The HMP/LID Sizing Calculator is an implementation tool, which is currently under development by the consultant team and will be completed by the time final HMP criteria go into effect.

- Prepare continuous simulation hydrologic models and compare the pre-project and mitigated post-project runoff peaks and durations (with hydromodification flow controls) until compliance to flow control standards can be demonstrated. The project applicant will be required to quantify the long-term pre- and post-project runoff response from the site and establish runoff routing and stage-storage-discharge relationships for the planned flow control devices. Public domain software such as HSPF, HEC-HMS and SWMM can be used for preparation of a continuous simulation hydrologic analysis.

- Points of compliance must be selected to conduct the comparisons of pre-project and post-project flows and durations. Generally, points of compliance are selected at locations along the project boundary where concentrated flows discharge from the project site. If a point of compliance is selected downstream of the project boundary, then the City should be consulted in advance of the hydromodification analysis. For projects which convey offsite runoff through the site, it is assumed that the offsite runoff would be separated from site runoff. If this is not the case, then the City should be consulted to further refine the points of compliance for the site (an interior project site point of compliance could be required in such a scenario).

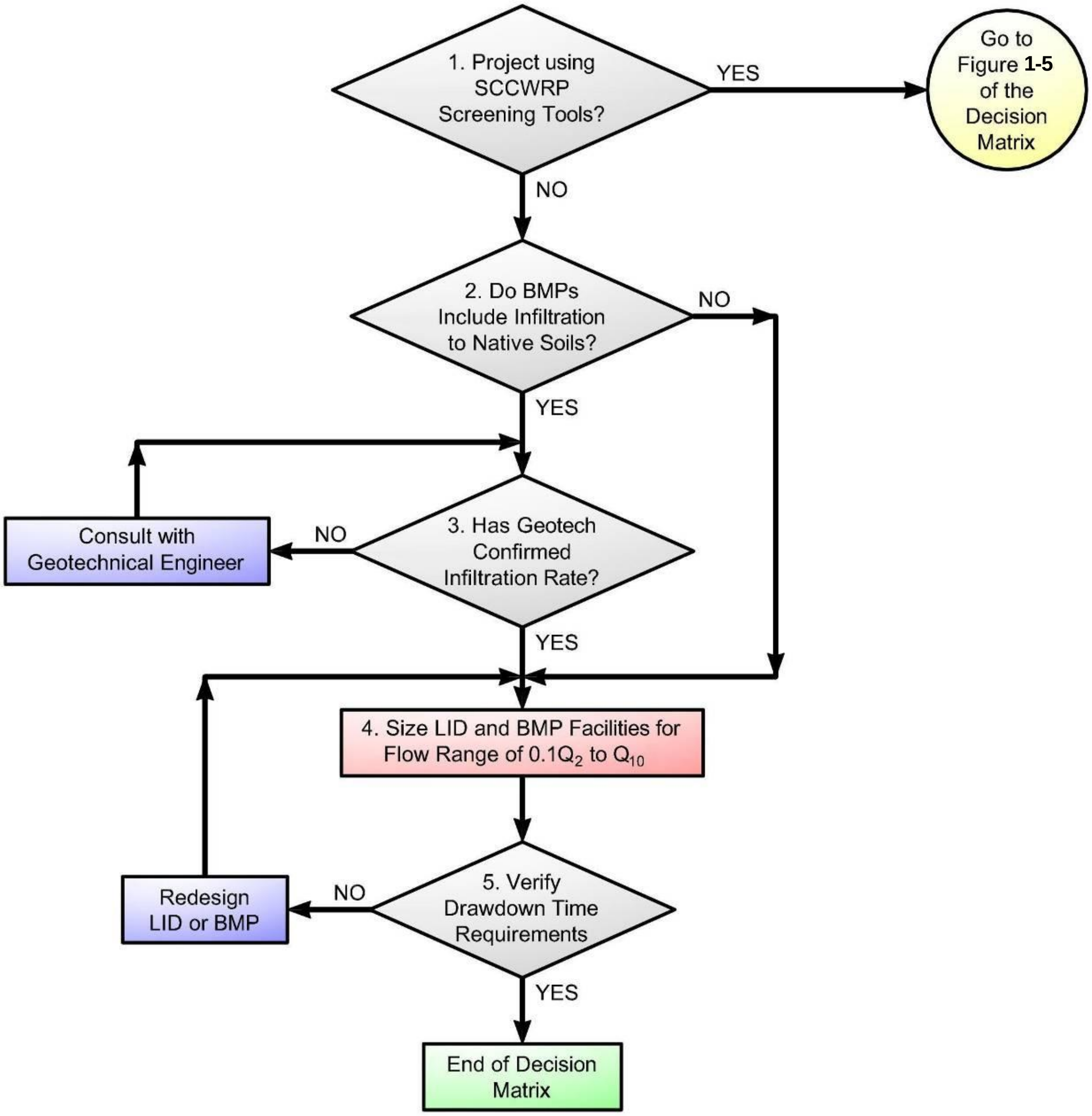


FIGURE 1-3. Mitigation Criteria and Implementation (Part 1)

- Figure 1-3, Node 1 – If the project applicant chooses to complete SCCWRP channel screening tools, then the applicant moves to Figures 1-4 and 1-5 to assess the vertical and lateral susceptibility of the receiving channel systems. Depending on the results of the SCCWRP screening tools and critical flow calculator, it is possible that lower flow thresholds in excess of $0.1Q_2$ may be used. If the project applicant chooses not to complete the SCCWRP channel assessment, then the applicant proceeds with Figure 1-3 of the Decision Matrix.

- Figure 1-3, Node 2 – If the project's LID or BMP approach accounts for the infiltration of runoff to native surrounding soils (below amended soil layers), then consultation with a geotechnical engineer is required (Box 3). If the project mitigation approach does not account for infiltration of runoff, then the applicant would proceed to Box 4.

- Figure 1-3, Node 3 – A geotechnical engineer should determine the allowable infiltration rates to be used for the design of each LID or BMP facility. The geotechnical assessment should also identify potential portions of the project which are feasible for infiltration of runoff.

- Figure 1-3, Node 4 – In this scenario, the SCCWRP channel assessment was not conducted. Therefore, the project applicant would be held to the $0.1Q_2$ lower flow threshold. LID and extended detention facilities must be sized so that the mitigated post project flows and durations do not exceed pre-project flows and durations for the geomorphically-significant flow range of $0.1Q_2$ to Q_{10}.

- Figure 1-3, Node 5 - The Decision Matrix includes language regarding a drawdown time requirements so that standards set forth by the County's Department of Environmental Health are met. As a side note, the County's Department of Environmental Health has stated that the drawdown requirement would be applied to underground vaults in addition to extended detention basins and the surface ponding areas of LID facilities. Proper maintenance of hydromodification mitigation facilities is essential to guard against potential vector issues as well potential safety issues resulting from long-term standing water. If mitigation facility outlets clog, then runoff will bypass the system and potentially result in additional erosion problems downstream of a site. The County Department of Environmental Health recently amended its drawdown time requirement to 96 hours.

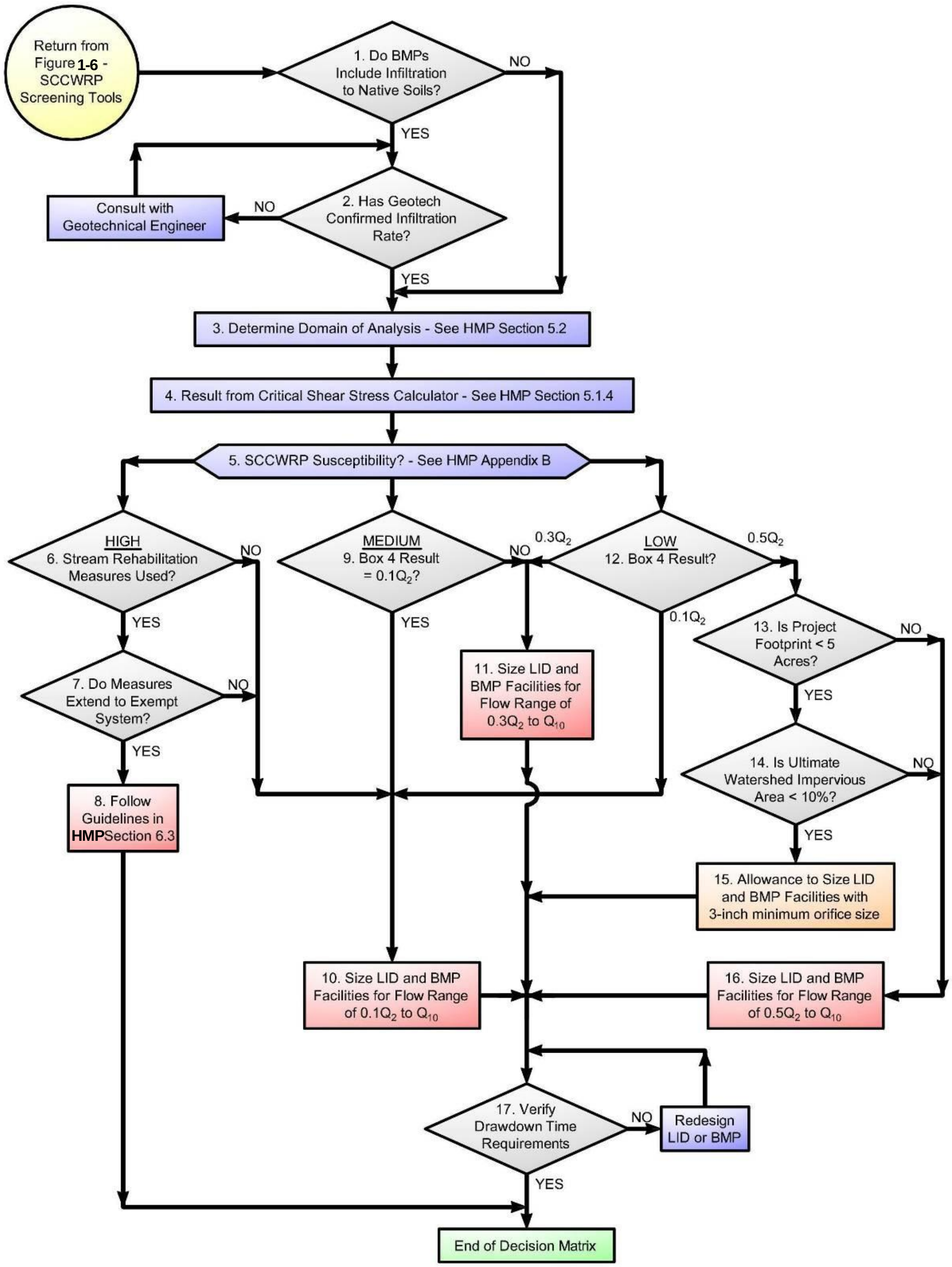


FIGURE 1-4. Mitigation Criteria and Implementation (Part 2)

- Figure 1-4, Node 1 – Use of Figure 1-4 assumes that the project applicant conducted the SCCWRP channel assessment. Box 1 would begin following completion of both the lateral and vertical susceptibility flow charts depicted in Figures 1-4 and 1-5. Box 1 is a decision box asking if the project's LID or BMP approach accounts for the infiltration of runoff to native surrounding soils (below amended soil layers). If the answer is Yes, then consultation with a geotechnical engineer is required (Box 2). If the project mitigation approach does not account for infiltration of runoff, then the applicant would proceed to Box 3.

- Figure 1-4, Node 2 – A geotechnical engineer should determine the allowable infiltration rates to be used for the design of each LID or BMP facility. The geotechnical assessment should also identify potential portions of the project which are feasible for infiltration of runoff.

- Figure 1-4, Node 3 – Pursuant to criteria detailed in HMP Section 5.2, the Domain of Analysis is determined downstream and upstream of the project site. This determination is used to ascertain the required reach length for data collection (channel bed and bank material, channel cross section data, etc.) required for the critical flow calculator (see Box 4).

- Figure 1-4, Node 4 – Pursuant to criteria detailed in HMP Section 5.1.4, the project applicant would run the critical shear stress calculator to determine if the recommended critical flow threshold should be $0.1Q_2$, $0.3Q_2$, or $0.5Q_2$. This result will be compared to the result from the SCCWRP screening analysis (Box 5) to determine the final lower flow threshold for the project.

- Figure 1-4, Node 5 – Pursuant to criteria detailed in HMP Appendix B, the project applicant would determine both the lateral and vertical channel susceptibility rating per guidelines set forth by SCCWRP. If the lateral and vertical tools returned divergent results, then the more conservative result would be used. SCCWRP susceptibility ratings include "High," "Medium" and "Low."

- Figure 1-4, Node 6 – A project applicant would arrive at Box 6 if the SCCWRP channel susceptibility rating was determined to be "High." This decision box inquires as to whether stream rehabilitation measures such as grade control and channel widening will be used as a mitigation measure instead of flow control. It should be noted that stream rehabilitation options are only allowed if the existing receiving channel susceptibility is considered to be "High."

- Figure 1-4, Node 7 – Stream rehabilitation measures are only allowed if the proposed mitigation project extends to a downstream exempt system (such as an exempt river system). If the mitigation measure did not extend to an exempt system, then the potential for cumulative watershed impacts would be more pronounced.

- Figure 1-4, Node 8 – If stream rehabilitation measures are allowed, then guidelines outlined in Section 6.3 of the HMP should be followed to design the in-stream mitigation approach.

- Figure 1-4, Node 9 - A project applicant would arrive at Box 9 if the SCCWRP channel susceptibility rating was determined to be "Medium." If the result from the critical shear stress calculator is also "Medium" (or $0.3Q_2$), then the lower flow threshold would be $0.3Q_2$ (Box 11). If the result from the critical shear stress calculator is "High" (or $0.1Q_2$), then the more conservative value would be used and the lower flow threshold would be $0.1Q_2$ (Box 10).

- Figure 1-4, Node 10 – For stream reaches determined by either the critical flow calculator or the SCCWRP screening tools to have a "High" susceptibility to erosion, LID and extended detention flow control facilities should be sized so that the mitigated post project flows and durations do not exceed pre-project flows and durations for the geomorphically-significant flow range of $0.1Q_2$ to Q_{10}.

- Figure 1-4, Node 11 - For stream reaches determined by either the critical flow calculator or the SCCWRP screening tools to have a "Medium" susceptibility to erosion, LID and extended detention flow control facilities should be sized so that the mitigated post project flows and durations do not exceed pre-project flows and durations for the geomorphically-significant flow range of $0.3Q_2$ to Q_{10}.

- Figure 1-4, Node 12 - A project applicant would arrive at Box 12 if the SCCWRP channel susceptibility rating was determined to be "Low." If the result from the critical shear stress calculator is also "Low" (or $0.5Q_2$), then the lower flow threshold would be $0.5Q_2$ (Box 16 – note potential waiver in Box 13). If the result from the critical shear stress calculator is "High" (or $0.1Q_2$), then the more conservative value would be used and the lower flow threshold would be $0.1Q_2$ (Box 10). If the result from the critical flow calculator is "Medium" (or $0.3Q_2$), then the more conservative value would be used and the lower flow threshold would be $0.3Q_2$ (Box 11).

- Figure 1-4, Node 13 – In some limited situations, namely small developments in rural or lightly developed areas, an allowance for a minimum outlet orifice size may be granted when the receiving channel susceptibility is "Low." This criteria may potentially be used for project footprints less than 5 acres. If the project footprint is greater than 5 acres, then the allowance may not be granted and the applicant would proceed to Box 16.

- Figure 1-4, Node 14 – The potential allowance discussed in Box 13 could only be granted if the ultimate potential impervious area in the sub-watershed is less than 10 percent. If there is potential for the sub-watershed impervious area to exceed 10 percent, then the minimum orifice size criteria may not be granted.

- Figure 1-4, Node 15 – If Boxes 12, 13, and 14 are satisfied, then mitigation facilities may be designed using a 3-inch minimum outlet orifice size.

- Figure 1-4, Node 16 - For stream reaches determined by either the critical flow calculator or the SCCWRP screening tools to have a "Low" susceptibility to erosion – and for projects where the minimum outlet orifice criteria does not apply - LID and extended detention flow control facilities should be sized so that the mitigated post project flows and durations do not exceed pre-project flows and durations for the geomorphically-significant flow range of $0.5Q_2$ to Q_{10}.

- Figure 1-4, Node 17 – For all hydromodification mitigation designs, the Decision Matrix includes language regarding drawdown time requirements so that standards set forth by the County's Department of Environmental Health are met. As a side note, the County's Department of Environmental Health has stated that the drawdown requirement would be applied to underground vaults in addition to extended detention basins and the surface ponding areas of LID facilities. Proper maintenance of hydromodification mitigation facilities is essential to guard against potential vector issues as well potential safety issues resulting from long-term standing water. If mitigation facility outlets clog, then runoff will bypass the system and potentially result in additional erosion problems downstream of a site. The County Department of Environmental Health recently amended its drawdown time requirement to 96 hours.

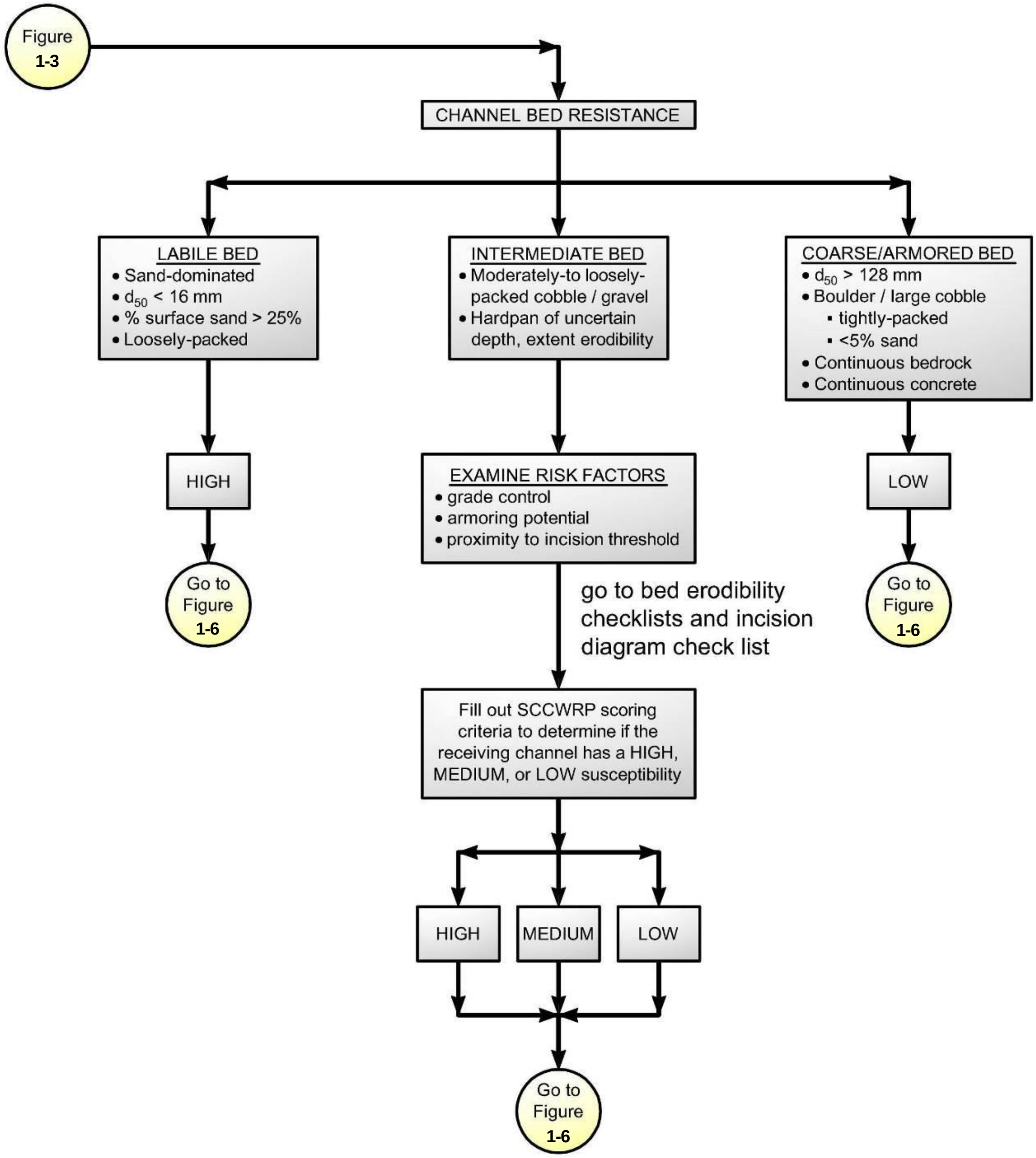


FIGURE 1-5. SCCWRP Vertical Susceptibility

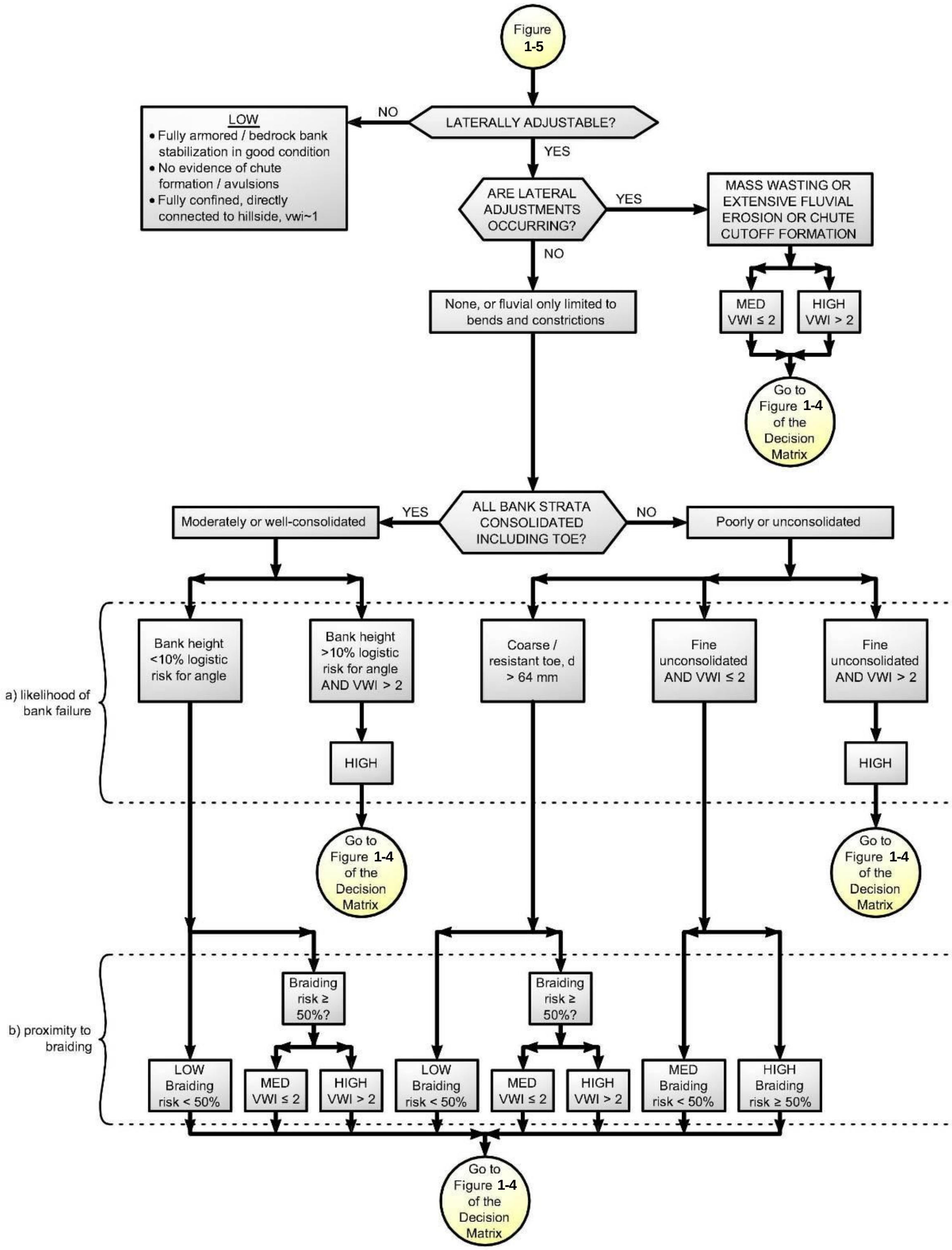


FIGURE 1-6. Lateral Channel Susceptibility

Grandfathering. Projects with prior lawful approval (such as a development agreement, vested tentative map, or a building or grading permit) that have started construction before the January 2011 adoption date, may not have to meet the hydromodification management requirements. Verify with City staff.

Waivers from Numeric Sizing Criteria

The NPDES permit allows for a project to be waived from numeric sizing criteria for storm water treatment **only** if all available treatment facilities have been considered and found **infeasible**. City staff must inform the Water Board within 5 days of granting a waiver. Other SUSMP requirements—including site designs to minimize imperviousness and source control BMPs—will still apply.

Experience has shown implementation of LID facilities, as described in Chapter 4, is feasible on nearly all development sites. However, the use of LID to retrofit existing drainage systems, to manage runoff from sites smaller than one acre in pedestrian-oriented developments, or to manage runoff from widened portions of roadways, sometimes presents special challenges. In these special situations, applicants should see the discussion of "Selection of Storm Water Treatment Facilities" in Chapter 2 and evaluate the options described on page 40 in order (depending on the specific characteristics of the project and as determined by the City of National City). All the options listed meet the numeric sizing criteria in the NPDES permit.

If infeasibility of all these options can be established, the City of National City may determine eligibility of the project for a waiver.

References and Resources:

- RWQCB Order R9-2007-0001 (Storm Water NPDES Permit)
- Project Clean Water web page

Chapter

2

Concepts and Criteria

Technical background and explanations of policies and design requirements

The Regional Water Board reissued a municipal storm water NPDES permit to San Diego County, its 18 cities, the San Diego Unified Port District, and the San Diego Regional Airport Authority in January 2007. The permit mandates a comprehensive program to prevent storm water pollution. That program now includes street sweeping, maintenance of storm drains, business inspections, public outreach, construction site inspections, monitoring, and studies of stream and ocean health, and control of runoff pollutants from new developments and redevelopments.

NPDES Permit Provision D.1.d. requires the City of National City to regulate projects in specific categories (Appendix A) to:

1. Reduce discharges of pollutants to the maximum extent practicable.

2. Prevent runoff discharges from causing or contributing to a violation of water quality standards.

The City of National City, along with the other Copermittees, has created a Low Impact Development (LID) design procedure (Chapter 4) that ensures consistent and thorough implementation of the Regional Water Board's requirements. This chapter explains the technical background of the LID approach and how it was derived.

The previous permit, issued in 2001, included a requirement to control the post-development peak storm water runoff rates and velocities to maintain or reduce pre-development downstream erosion and protect stream habitat. The 2007 permit includes, in addition to this ongoing requirement, a new requirement to develop a hydromodification management plan (HMP) to identify and define a methodology and performance criteria to ensure flow rates and durations do not exceed pre-project runoff where increased runoff could cause erosion or other significant adverse impacts to beneficial uses.

As required by the NPDES permit, the City of National City has adopted final hydromodification criteria. See Chapter One.

Water-Quality Regulations

NPDES Permit Provision D.1 requires the City of National City to condition development approvals on incorporation of specified storm water controls.

Provision D.1 requires applicable new developments and redevelopments:

- Design the site to conserve natural areas, existing trees and vegetation and soils, to maintain natural drainage patterns, to minimize imperviousness, to detain runoff, and to infiltrate runoff where feasible

- Cover or control sources of storm water pollutants

- Treat runoff prior to discharge. Provision E.10 states: "Urban runoff treatment and/or mitigation must occur prior to the discharge of urban runoff into a receiving water. Federal regulations at 40 CFR 131.10(a) state that in no case shall a state adopt waste transport or waste assimilation as a designated use for any waters of the U.S."

- Ensure runoff does not exceed pre-project peaks and durations where increases could affect downstream habitat or other beneficial uses

- Maintain treatment and flow-control facilities

The City of National City maintains a database to track approved installations of treatment facilities and to verify facilities are maintained. The City's annual report to the Regional Water Board includes a list of development projects subject to SUSMP conditions and descriptions of those projects that:

- Received a waiver from SUSMP criteria; and

- Used hydrologic controls used to meet HMP requirements, including a description of the controls.

The City of National City must also report the number of violations and enforcement actions taken upon development projects. The City of National City's programs are subject to audit by the Regional Water Board.

The City of National City—not the Regional Water Board or its staff—is charged with ensuring development projects comply with the D.1 requirements. Regional Water Board staff sometimes review storm water controls and hydromodification impacts in connection with applications for Clean Water Act Section 401 water-quality certification, which is required for projects that involve work, such as dredging or placement of fill, within streams, creeks, or other waters of the US.

► **MAXIMUM EXTENT PRACTICABLE**

Clean Water Act Section 402(p)(3)(iii) sets the standard for storm water controls as "maximum extent practicable," but doesn't define that term. As implemented, "maximum extent practicable" is ever-changing and varies with conditions.

Many storm water controls, including LID facilities, have proven to be practicable in most site development projects. To achieve fair and effective implementation, criteria, and guidance, requirements for controls must be detailed and specific—while also offering the right amount of flexibility or exceptions for special cases. The NPDES permit includes various standards, including hydrologic criteria, which have been found to comprise "maximum extent practicable." This SUSMP Manual is to be continuously improved and refined based on the experience of City planners and engineers, with input from land developers and development professionals. By following the SUSMP Manual, applicants can ensure their project design meets "maximum extent practicable."

► **BEST MANAGEMENT PRACTICES**

Clean Water Act Section 402(p) and USEPA regulations (40 CFR 122.26) specify a municipal program of "management practices" to control storm water pollutants. **Best Management Practice (BMP)** refers to any kind of procedure, activity, or device designed to minimize the quantity of pollutants that enter the storm drain system. BMPs are typically used in place of assigning numeric effluent limits. The criteria for source control BMPs and treatment and flow-control facilities are crafted to fulfill "maximum extent practicable."

To minimize confusion, this guidebook refers to "facilities," "features," or "controls" to be incorporated into development projects. All of these are BMPs.

Pollutants of Concern

NPDES Permit Provision D.1.d.(3) requires the City of National City to develop and implement a procedure for pollutants of concern to be identified for each Priority Development Project.

Documentation of the approach to identifying pollutants of concern and selecting BMPs and facilities follows.

► **GROUPING OF POTENTIAL POLLUTANTS OF CONCERN**

Urban runoff from a developed site has the potential to contribute pollutants, including oil and grease, suspended solids, metals, gasoline, pesticides, and pathogens to the storm water conveyance system and receiving waters. For the purposes of identifying pollutants of concern and associated storm water BMPs, pollutants are grouped in nine general categories as follows:

- **Sediments** are soils or other surficial materials eroded and then transported or deposited by the action of wind, water, ice, or gravity. Sediments can increase turbidity, clog fish gills, reduce spawning habitat, lower young aquatic organisms survival rates, smother bottom dwelling organisms, and suppress aquatic vegetation growth.

- **Nutrients** are inorganic substances, such as nitrogen and phosphorus. They commonly exist in the form of mineral salts that are either dissolved or suspended in water. Primary sources of nutrients in urban runoff are fertilizers and eroded soils. Excessive discharge of nutrients to water bodies and streams can cause excessive aquatic algae and plant growth. Such excessive production, referred to as cultural eutrophication, may lead to excessive decay of organic matter in the water body, loss of oxygen in the water, release of toxins in sediment, and the eventual death of aquatic organisms.

- **Metals** are raw material components in non-metal products such as fuels, adhesives, paints, and other coatings. Primary sources of metal pollution in storm water are typically commercially available metals and metal products. Metals of concern include cadmium, chromium, copper, lead, mercury, and zinc. Lead and chromium have been used as corrosion inhibitors in primer coatings and cooling tower systems. At low concentrations naturally occurring in soil, metals are not toxic. However, at higher concentrations, certain metals can be toxic to aquatic life. Humans can be impacted from contaminated groundwater resources, and bioaccumulation of metals in fish and shellfish. Environmental concerns, regarding the potential for release of metals to the environment, have already led to restricted metal usage in certain applications.

- **Organic compounds** are carbon-based. Commercially available or naturally occurring organic compounds are found in pesticides, solvents, and hydrocarbons. Organic compounds can, at certain concentrations, indirectly or directly constitute a hazard to life or health. When rinsing off objects, toxic levels of solvents and cleaning compounds can be discharged to storm drains. Dirt, grease, and grime retained in the cleaning fluid or rinse water may also adsorb levels of organic compounds that are harmful or hazardous to aquatic life.

- **Trash** (such as paper, plastic, polystyrene packing foam, and aluminum materials) and biodegradable organic matter (such as leaves, grass cuttings, and food waste) are general waste products on the landscape. The presence of trash & debris may have a significant impact on the recreational value of a water body and aquatic habitat. Excess organic matter can create a high biochemical oxygen demand in a stream and thereby lower its water quality. Also, in areas where stagnant water exists, the presence of excess organic matter can promote septic conditions resulting in the growth of undesirable organisms and the release of odorous and hazardous compounds such as hydrogen sulfide.

- **Oxygen-Demanding Substances** includes biodegradable organic material as well as chemicals that react with dissolved oxygen in water to form other compounds. Proteins, carbohydrates, and fats are examples of biodegradable organic compounds. Compounds such as ammonia and hydrogen sulfide are examples of oxygen-demanding compounds. The oxygen demand of a substance can lead to depletion of dissolved oxygen in a water body and possibly the development of septic conditions.

- Primary sources of **oil and grease** are petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high molecular-weight fatty acids. Introduction of these pollutants to the water bodies are very possible due to the wide uses and applications of some of these products in municipal, residential, commercial, industrial, and construction areas. Elevated oil and grease content can decrease the aesthetic value of the water body, as well as the water quality.

- **Bacteria and Viruses** are ubiquitous microorganisms that thrive under certain environmental conditions. Their proliferation is typically caused by the transport of animal or human fecal wastes from the watershed. Water, containing excessive bacteria and viruses can alter the aquatic habitat and create a harmful environment for humans and aquatic life. Also, the decomposition of excess organic waste causes increased growth of undesirable organisms in the water.

- **Pesticides** (including herbicides) are chemical compounds commonly used to control nuisance growth or prevalence of organisms. Excessive application of a pesticide may result in runoff containing toxic levels of its active component.

► IDENTIFYING POLLUTANTS OF CONCERN BASED ON LAND USES

Table 2-1 associates pollutants with the typical land uses of Priority Development Projects. Pollutants associated with any hazardous material sites that have been remediated or are not threatened by the proposed project are not considered a pollutant of concern.

► WATERSHEDS WITH SPECIAL POLLUTANT CONCERNS

Receiving water conditions may require specialized attention. The four conditions to consider include:

- Ocean waters designated as an **Area of Special Biological Significance (ASBS)**

- Water bodies and surrounding areas designated by the City as Environmentally Sensitive Areas (ESA)

- 303(d) listed waters; and

- Waters with established Total Maximum Daily Loads (TMDL).

TABLE 2-1. Anticipated and Potential Pollutants Generated by Land Use Type.

	General Pollutant Categories								
Land Use Type	Sediment	Nutrients	Heavy Metals	Organic Compounds	Trash & Debris	Oxygen Demanding Substances	Oil & Grease	Bacteria & Viruses	Pesticides
Detached Residential Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P(1)	P(2)	P	X
Commercial Development	P(1)	P(1)	X	P(2)	X	P(5)	X	P(3)	P(5)
Heavy Industry	X		X	X	X	X	X		
Automotive Repair Shops			X	X(4)(5)	X		X		
Restaurants					X	X	X	X	P(1)
Hillside Development >5,000 ft²	X	X			X	X	X		X
Parking Lots	P(1)	P(1)	X		X	P(1)	X		P(1)
Retail Gasoline Outlets			X	X	X	X	X		
Streets, Highways & Freeways	X	P(1)	X	X(4)	X	P(5)	X	X	P(1)

X = anticipated
P = potential
(1) A potential pollutant if landscaping exists on-site.
(2) A potential pollutant if the project includes uncovered parking areas.
(3) A potential pollutant if land use involves food or animal waste products.
(4) Including petroleum hydrocarbons.
(5) Including solvents.

Currently, there are no ASBS downstream of the City of National City. See Table 2-2 for a list of receiving water bodies within the City of National City, and their special pollutant concerns, if any. Note that ESA designations and 303(d) listings are updated periodically; please check with City of National City staff for the most updated list.

TABLE 2-2. City of National City Receiving Water Bodies

Receiving Waterbody	Hydrologic Sub-Area	Special Pollutant Concerns
San Diego Bay	908.31,908.32, 909.11, 909.12	Polychlorinated biphenyls (PCBs)
San Diego Bay Shoreline at Seventh Street Channel	908.31	Benthic Community Effects, Sediment Toxicity
Seventh Street Channel (La Paleta Creek)	908.31	Copper, Lead
Paradise Creek	908.32	ESA
Paradise Marsh	908.32	ESA
Sweetwater River	909.12	*Enterococcus* (bacteria), Fecal Coliform (bacteria), Phosphorus, Selenium, Total Dissolved Solids, Total Nitrogen as N, Toxicity
Sweetwater Marsh	909.12	ESA

Several receiving waters in San Diego County are listed as impaired for constituents or water quality effects pursuant to **Section 303(d)** of the Clean Water Act. Placement of a water body onto the list requires the Regional Board to make further analysis of the impairment and develop a TMDL for addressing the impairment. The 303(d) listing in itself does not demand that a project proponent select BMPs on the basis of the impairment; however, the project proponent should be cognizant of the impairment and the future implications a TMDL might have upon the proposed land use.

Check the website below for the most current 303(d) listings.
http://www.waterboards.ca.gov/sandiego/water_issues/programs/303d_list/index.shtml

Once a TMDL is established it may impose conditions on development either through an implementation plan and schedule for the listed water, or through special conditions required of the City of National City affected by the numeric criteria of the TMDL. At this time, several 303(d) listings in San Diego County are at various stages of TMDL development, and no adopted TMDL directly impacts the City of National City. However, there are approximately 190 pending TMDLs in the county. At the time of the adoption of this document, one pending applicable **TMDL** exists in the National City area for sediment toxicity for the mouth of La Paleta Creek (Seventh Street Channel) in San Diego Bay. The likely target constituents of this TMDL will be PCBs, PAHs, and Chlordane, and copper and lead may also be included.

The applicant should meet with City staff to determine if any project characteristics or watershed characteristics affect selection and design of BMPs. Except in rare circumstances, the use of the

LID Design Guide (Chapter 4) and the Storm Water Pollutant Sources/Source Control Checklist (Appendix C) will ensure your project complies with all storm water requirements.

Selection of Permanent Source Control BMPs

Based on identification of potential pollutants of concern associated with various types of facilities, the City of National City has developed a Storm Water Pollutant Sources/Source Control Checklist (Appendix C) of "maximum extent practicable" source controls associated with each facility type. This approach ensures appropriate BMPs are applied to potential sources of each pollutant of concern.

Selection of Storm Water Treatment Facilities

Table 2-3, below, categorizes pollutants of concern by fate during storm water treatment.

Table 2-4, below, includes a general comparison of how various types of treatment facilities perform for each group of pollutants.

TABLE 2-3. Grouping of Potential Pollutants of Concern by Fate During Storm Water Treatment

Pollutant	Coarse Sediment and Trash	Pollutants that tend to associate with fine particles during treatment	Pollutants that tend to be dissolved following treatment
Sediment	X	X	
Nutrients		X	X
Heavy Metals		X	
Organic Compounds		X	
Trash & Debris	X		
Oxygen Demanding		X	
Bacteria		X	
Oil & Grease		X	
Pesticides		X	

TABLE 2-4. Groups of Pollutants and Relative Effectiveness of Treatment Facilities

Pollutants of Concern	Bioretention Facilities (LID)	Settling Basins (Dry Ponds)	Wet Ponds and Constructed Wetlands	Infiltration Facilities or Practices (LID)	Media Filters	Higher-rate biofilters*	Higher-rate media filters*	Trash Racks & Hydro -dynamic Devices	Vegetated Swales
Coarse Sediment and Trash	High	High	High	High	High	High	High	High	High
Pollutants that tend to associate with fine particles during treatment	High	High	High	High	High	Medium	Medium	Low	Medium
Pollutants that tend to be dissolved following treatment	Medium	Low	Medium	High	Low	Low	Low	Low	Low

*See page 40 for a discussion of selection of treatment facilities in special situations.

Based on this analysis, the City of National City has determined that the following types of facilities are appropriate for treatment of runoff potentially containing most pollutants of concern. These types of facilities can be used for storm water treatment and hydromodification flow control for all land uses in all watersheds, except where site-specific constraints make them infeasible.

- Infiltration facilities or practices, including dry wells, infiltration trenches, infiltration basins, and other facilities that infiltrate runoff to native soils (sized to detain and infiltrate a volume equivalent to the 85th percentile 24-hour water quality runoff event – greater capacity required to provide hydromodification flow control).

- Bioretention facilities and media filters that detain storm water and filter it slowly through soil or sand (sized with a surface area at least 0.04 times the effectively impervious tributary area for water quality treatment – a larger sizing factor is required to provide hydromodification flow control).

- Extended detention basins, wet ponds, and wetlands or other facilities using settling (sized to detain a volume equivalent to runoff from the tributary area generated by the 85th percentile 24-hour water quality runoff event – greater capacity required to provide hydromodification flow control).

The recommended design procedure in Chapter 4 integrates LID practices—optimizing the site design, using pervious surfaces, and dispersing of runoff to adjacent pervious areas—with the use of infiltration facilities, detention basins, and bioretention facilities to meet NPDES permit LID requirements, treatment requirements, and flow-control requirements in a cost-effective, unified design.

Oil/water separators ("water quality inlets"), storm drain inlet filters, and hydrodynamic separators, including vortex separators and continuous deflection separators ("CDS units"), are less effective means of storm water treatment, although they may be used in series with more effective facilities.

Underground vaults typically lack the detention time required for settling of fine particles associated with storm water pollutants. They also require frequent maintenance and may retain stagnant water, potentially providing harborage for mosquitoes. Because vaults may be "out of sight, out of mind," experience shows that the required maintenance may not occur.

Lack of space, in itself, is not a suitable justification for using a less-effective treatment on a development site, because the uses of the site and the site design can be altered as needed to accommodate bioretention facilities or planter boxes. In most cases, these effective facilities can be fit into required landscaping setbacks, easements, or other unbuildable areas.

Where possible, drainage to inlets, and drainage away from overflows and underdrains, should be by gravity. Where site topography makes it infeasible to accommodate gravity-fed facilities in the project design, the design flow may be captured in a vault or sump and pumped via force main to an effective facility.

The following situations sometimes present special challenges:

- Portions of sites which are not being developed or redeveloped, but which must be retrofit to meet treatment requirements in accordance with Provision D.1.d.(1)(a) which states in part: "Where redevelopment results in an increase of, or replacement of, more than fifty percent of the impervious surface of a previously existing development, the numeric sizing criteria applies to the entire development."
- Sites smaller than one acre approved for development or redevelopment as part of a municipality's stated objective to preserve or enhance a pedestrian-oriented "smart-growth" type of urban design.
- Roadway widening projects.

In these special situations, the following types of facilities should each be evaluated in priority order (depending on the specific characteristics of the site and as determined by the City) until a feasible design is found.

1. Bioretention areas or planter boxes fed by gravity.
2. Capture of the design flow in a vault or sump and pumping to bioretention areas or planter boxes.
3. A subsurface sand or media filter with a maximum design surface loading rate of 5 inches per hour and a minimum media depth of 18 inches. The sand surface must be made accessible for periodic inspection and maintenance (for example, via a removable grating).

4. A higher-rate surface biofilter, such as a tree-pit-style unit. The grading and drainage design should minimize the area draining to each unit and maximize the number of discrete drainage areas and units.

5. A higher-rate vault-based filtration unit (for example, vaults with replaceable cartridge filters filled with inorganic media).

Proprietary Devices
Many currently available proprietary devices do not meet City of National City requirements when used alone for storm water treatment. Consult with City staff before proposing these devices.

Many proprietary storm water treatment devices are currently marketed, and new brands will be introduced. Applicants and applicants' engineers and design professionals should review with City staff any proposals for using proprietary devices for storm water treatment before they commence work on preliminary site layout, drainage plans, grading plans, or landscape plans.

Hydrology for NPDES Compliance

► IMPERVIOUSNESS

Schueler (1995) proposed **imperviousness** as a "unifying theme" for the efforts of planners, engineers, landscape architects, scientists, and local officials concerned with urban watershed protection. Schueler argued (1) that imperviousness is a useful indicator linking urban land development to the degradation of aquatic ecosystems, and (2) imperviousness can be quantified, managed, and controlled during land development.

Imperviousness has long been understood as the key variable in urban hydrology. Peak runoff flow and total runoff volume from small urban catchments is usually calculated as a function of the ratio of impervious area to total area **(rational method)**. The ratio correlates to the runoff factor, usually designated "C". Increased flows resulting from urban development tend to increase the frequency of small-scale flooding downstream.

Imperviousness links urban land development to degradation of aquatic ecosystems in two ways.

First, the combination of paved surfaces and piped runoff efficiently collects urban pollutants and transports them, in suspended or dissolved form, to surface waters. These pollutants may originate as airborne dust, be washed from the atmosphere during rains, or may be generated by automobiles and outdoor work activities.

Second, increased peak flows and runoff durations typically cause erosion of stream banks and beds, transport of fine sediments, and disruption of aquatic habitat. Measures taken to control stream erosion, such as hardening banks with riprap or concrete, may permanently eliminate habitat. By reducing infiltration to groundwater, imperviousness may also reduce dry-weather stream flows.

Imperviousness has two major components: rooftops and transportation (including streets, highways, and parking areas). The transportation component is usually larger and is more likely to be **directly connected** to the storm drain system.

The effects of imperviousness can be mitigated by disconnecting impervious areas from the drainage system and by encouraging detention and retention of runoff near the point where it is generated. Detention and retention reduce peak flows and volumes and allow pollutants to settle out or adhere to soils before they can be transported downstream.

► LOW IMPACT DEVELOPMENT REQUIREMENTS

The NPDES permit requires LID be used on all projects to minimize directly connected impervious area and promote infiltration. For Priority Development Projects, the minimum standards are:

- Drain a portion of impervious areas into pervious areas, if any.
- Design and construct pervious areas, if any, to effectively receive and infiltrate runoff from impervious areas, taking into account soil conditions, slope, and other pertinent factors.
- Construct a portion of paved areas with low traffic and appropriate soil conditions with permeable surfaces.

The LID design procedure in Chapter 4 incorporates these requirements into an integrated design which meets sizing requirements for storm water treatment facilities and flow-control (hydromodification management) requirements.

► SIZING REQUIREMENTS FOR STORM WATER TREATMENT FACILITIES

The guidance in Chapter 4 was crafted to ensure LID facilities comply with the NPDES permit's hydraulic sizing requirements for storm water treatment facilities and flow-control facilities. The technical background follows.

Most runoff is produced by frequent storms of small or moderate intensity and duration. Treatment facilities are designed to treat smaller storms and the first flush of larger storms—approximately 80% of average annual runoff.

The NPDES permit identifies two types of treatment facilities—volume-based and flow-based.

Volume-based facilities must be designed to infiltrate, filter, or treat the volume of runoff produced from a 24-hour 85th percentile storm event as determined from the County of San Diego's 85th Percentile Precipitation Isopluvial Map. As shown on the map, rainfall depths vary from about 0.55" to 1.55".

For **flow-based** facilities, the NPDES permit specifies the rational method be used to determine flow. The rational method uses the equation

$Q = CiA$, where

Q = flow

C = weighted runoff factor between 0 and 1

i = rainfall intensity

A = area

The permit identifies two alternatives for calculating rainfall intensity:

1. the 85th percentile rainfall intensity times two, or
2. 0.2 inches per hour.

It is typically found that both methods yield similar results. The 0.2 inches per hour rainfall intensity should be used for sizing flow-based treatment facilities.

The 0.2 inches per hour criterion is the basis for a **consistent countywide sizing factor** for bioretention facilities when used for storm water treatment only (i.e., not for flow control). The factor is based on maintaining a minimum percolation rate of 5 inches per hour through the engineered soil mix. The sizing factor is the ratio of the design intensity of rainfall on tributary impervious surfaces (0.2 inches/hour) to the design percolation rate in the facility (5 inches/hour), or **0.04** (dimensionless).

► FLOW-CONTROL (HYDROMODIFICATION MANAGEMENT)

The NPDES permit specifies for applicable projects:

> … post-project runoff flow rates and durations shall not exceed pre-project runoff flow rates and durations where the increased discharge flow rates and durations will result in increased potential for erosion or other significant adverse impacts to beneficial uses, attributable to changes in flow rates and durations.

Refer to Appendix E to review the final Hydromodification Management Plan (HMP) developed by the San Diego Copermittees and approved by the RWQCB in July 2010. A summary of the HMP document is provided in Chapter 1 of this SUSMP Manual.

Criteria for Infiltration Devices

The NPDES permit restricts the design and location of "infiltration devices" that, as designed, may bypass filtration through surface soils before reaching groundwater. These devices include:

- Infiltration basins.
- Infiltration trenches (includes French drains).
- Unlined retention basins (i.e., basins with no outlets).
- Unlined or open-bottomed vaults or boxes installed below grade (dry wells).

Infiltration devices may not be used in:

- Areas of industrial or light industrial activity; areas subject to high vehicular traffic (25,000 or greater average daily traffic on main roadway or 15,000 or more average daily traffic on any intersecting roadway);
- Automotive repair shops;
- Car washes;
- Fleet storage areas (bus, truck, etc.);
- Nurseries;
- Other areas with pollutant sources that could pose a threat to groundwater, as designated by the City of National City.

The vertical distance from the base of any infiltration device to the seasonal high groundwater mark shall be at least 10 feet. Infiltration devices shall be located a minimum of 100 feet horizontally from any known water supply wells.

In addition, infiltration devices are not recommended where:

- The infiltration device would receive drainage from areas where chemicals are used or stored, where vehicles or equipment are washed, or where refuse or wastes are handled.
- Surface soils or groundwater are polluted.
- The facility could receive sediment-laden runoff from disturbed areas or unstable slopes.
- Increased soil moisture could affect the stability of slopes of foundations.
- Soils are insufficiently permeable to allow the device to drain within 96 hours (based on the County Department of Environmental Health minumum drawdown time).

► MOST LID FEATURES AND FACILITIES ARE NOT INFILTRATION DEVICES

Self-treating and self-retaining areas, pervious pavements, bioretention facilities, and planter boxes are not considered to be infiltration devices.

Bioretention facilities work by percolating runoff through 18 inches or more of engineered soil. This removes most pollutants before the runoff is allowed to seep into native soils below. Further pollutant removal typically occurs in the unsaturated (vadose) zone before moisture reaches groundwater.

Where there is concern about the effects of increased soil moisture on slopes or foundations, an impermeable barrier may be added so the facility is "flow through" and all treated runoff is underdrained away from the facility. See the design sheets for Bioretention Facilities and Flow-Through Planters in Appendix B.

References and Resources:

- RWQCB Order R9-2007-0001 (Storm Water NPDES Permit)
- *County of San Diego Low Impact Development Handbook*
- Clean Water Act Section 402(p)
- 40 CFR 122.26
- San Diego Regional Water Quality Control Board—TMDLs
- State Water Resources Control Board—Ocean Standards
- *Site Planning for Urban Stream Protection* (Schueler, 1995).
- "Application of Water-Quality Engineering Fundamentals to the Assessment of Stormwater Treatment Devices" (Salvia, 2000).

Chapter

3

Preparing Your Project Submittal

Step-by-step assistance to demonstrate compliance.

Your Project Submittal will demonstrate your project complies with all applicable requirements in the storm water NPDES permit—to minimize imperviousness, retain or detain storm water, slow runoff rates, incorporate required source controls, treat storm water prior to discharge, control runoff rates and durations, and provide for operation and maintenance of treatment and flow-control facilities.

Submittal requirements vary from jurisdiction to jurisdiction. See below for the specific requirements of the City of National City.

Typically, your Project Submittal must be coordinated with your application for discretionary approvals and must have sufficient detail to ensure the storm water design, site plan, and landscaping plan are congruent.

A complete and thorough Project Submittal will facilitate quicker review and fewer cycles of review. The City of National City requires a submittal for every applicable project. For projects that do not fall into any Priority Development Project category, see City staff for applicable storm water requirements. This chapter contains Project Submittal requirements for Priority Development Projects. The step by step procedure in this chapter is highly recommended by the City of National City; any other approaches to meeting the requirements of this SUSMP Manual must be shown by the project proponent to be defensibly equivalent or better.

City staff may use a review checklist such as the following example to evaluate your Project Submittal:

EXAMPLE PROJECT SUBMITTAL CHECKLIST

SUBMITTAL COMPONENT REQUIREMENTS FOR PRIORITY DEVELOPMENT PROJECTS

- ❒ Completed Applicability Checklist (Appendix A)
- ❒ Vicinity Map
- ❒ Site Map (See below for contents of Exhibit.)
- ❒ SUSMP Report (See below for contents of Report.)
- ❒ Hydromodification Management Study, which describes how requirements are met (if applicable)

CONTENTS OF EXHIBIT (SITE MAP)

Show all of the following on drawings:

- ❒ Show entire property on one map. Use key map if multiple sheets are necessary. (Step 1 in the following step-by-step instructions)
- ❒ Existing natural hydrologic features (depressions, watercourses, floodplains, relatively undisturbed areas) and significant natural resources. (Step 1)
- ❒ Areas of potential soil erosion on the property and downstream of the project. (Step 1)
- ❒ Soil types and depth to groundwater. (Step 1)
- ❒ Existing and proposed site drainage network and connections to drainage off-site, including surface conveyances, private storm drain systems, and municipal storm drain inlets. (Step 3)
- ❒ Proposed design features and surface treatments used to minimize imperviousness. (Step 3)
- ❒ Entire site divided into separate drainage areas, with each area identified as self-treating, self-retaining (zero-discharge), draining to a self-retaining area, or draining to an IMP. (Step 3)
- ❒ For each drainage area, types of impervious area proposed (roof, plaza/sidewalk, and streets/parking) and area of each. (Step 3)
- ❒ Proposed locations and sizes of treatment or flow-control facilities. (Step 3)
- ❒ Potential pollutant source areas, including refuse areas, outdoor work and storage areas, etc. listed in Appendix C and corresponding required source controls. (Step 4)

CONTENTS OF REPORT

Include all of the following in your SUSMP Report:

- ❒ Table of Contents
- ❒ Identification of the watershed(s), downstream waterbodies, waterbody impairments, and pollutants of concern (Step 1)
- ❒ Narrative analysis or description of site features and conditions that constrain, or provide opportunities for, storm water control. (Step 2)
- ❒ If the project is exempt from HMP requirements, a discussion must be included demonstrating which exemption is being claimed and why the project qualifies (Step 2).

- ❐ Demonstrate how hydromodification requirements are met, including calculations justifying determination of lower flow thresholds and the sizing of LID or extended detention facilities to provide for hydromodification flow control. Field investigation results and continuous simulation results should also be included where applicable (Step 3).
- ❐ Narrative description of site design characteristics that protect natural resources. (Step 3)
- ❐ Narrative description and/or tabulation of site design characteristics, building features, and pavement selections that reduce imperviousness of the site. (Step 3)
- ❐ Basis for selection of each proposed engineered LID IMP or alternative treatment facility. (Step 3)
- ❐ Tabulation of proposed pervious and impervious area, showing self-treating areas, self-retaining areas, and areas tributary to each treatment or flow-control facility. (Step 3)
- ❐ Preliminary designs, including calculations, for each infiltration, treatment, or flow-control facility. Elevations should show sufficient hydraulic head for each. (Step 3)
- ❐ A table of identified pollutant sources and for each source, the source control measure(s) used to reduce pollutants to the maximum extent practicable. See worksheet in Appendix C. (Step 4)
- ❐ General maintenance requirements for treatment and flow-control facilities (Step 5)
- ❐ Means by which facility maintenance will be financed and implemented in perpetuity. (Step 5)
- ❐ Statement accepting responsibility for operation & maintenance of facilities (Step 5).
- ❐ Identification of any conflicts with codes or requirements or other anticipated obstacles to implementing the proposed facilities in the submittal (Step 6).
- ❐ Construction Plan SUSMP Checklist (Step 6).
- ❐ Certification by a registered civil engineer (Step 6).

Step by Step

Suggested coordination with site and landscape design

Begin with general project requirements and program.

Sketch conceptual site layout, building locations, and circulation.

Revise site layout, building locations, and circulation to accommodate LID design. Develop land-scaping plan.

Submit Site Plan, Landscape Plan, and SUSMP Submittal

Plan and design your storm water controls integrally with the site planning and landscaping for your project. It's best to start with general project requirements and preliminary site design concepts, then prepare the detailed site design, landscape design, and storm water control design simultaneously. **This will help ensure that your site plan, landscape plan, and Project Submittal are congruent.**

The following step-by-step procedure should optimize your design by identifying the best opportunities for storm water controls **early in the design process.**

The recommended steps are:

1. Assemble needed information.
2. Identify site opportunities and constraints.
3. Follow the LID design guidance in Chapter 4 to analyze your project for LID and to develop and document your drainage design.
4. Specify source controls using the sources/source control checklist in Appendix C.
5. Plan for ongoing maintenance of treatment and flow-control facilities.
6. Complete the Project Submittal.

City staff may recommend you prepare and submit a preliminary site design prior to formally applying for planning and zoning approvals. Your preliminary site design should incorporate a conceptual plan for site drainage, including self-treating and self-retaining areas and the location and approximate sizes of any treatment facilities. This additional up-front design effort will save time and avoid potential delays later in the review process.

Step 1: Assemble Needed Information

To select types and locations of treatment facilities, the designer needs to know the following site characteristics:

- **Existing natural hydrologic features** and natural resources, including any contiguous natural areas, wetlands, watercourses, seeps, or springs.

- **Existing site topography**, including contours of any slopes of 4% or steeper, general direction of surface drainage, local high or low points or depressions, any outcrops or other significant geologic features.

- **Zoning**, including requirements for **setbacks** and **open space**.

- **Public Works Standards** or other local codes governing minimum street widths, sidewalk construction, allowable pavement types, and drainage. These codes may conflict with Low Impact Development objectives to minimize imperviousness and to maintain or restore natural site hydrology.

- Soil types (including **hydrologic soil groups**) and depth to groundwater, which may determine whether infiltration is a feasible option for managing site runoff. Depending on site location and characteristics, and on the selection of treatment and flow-control facilities, site-specific information (e.g. from boring logs or geotechnical studies) may be required.

- **Existing site drainage.** For undeveloped sites, this should be obtained by inspecting the site and examining topographic maps and survey data. For previously developed sites, site drainage and connection to the municipal storm drain system can be located from site inspection, municipal storm drain maps, and plans for previous development.

- Existing **vegetative cover** and **impervious areas**, if any.

- **Watershed(s)** in which the project area is located.

- **Applicable hydromodification management requirements** for the project, or evidence for any exemptions from requirements based on the Regional HMP. Note that field investigation is typically required for projects subject to hydromodification management requirements.

- **Pollutants of Concern** in receiving waters. For each of the proposed project discharge points, identify the receiving water(s), including hydrologic unit basin number(s), as identified in the most recent version of the Water Quality Control Plan for the San Diego Basin[1], prepared by the San Diego Regional Water Quality Control Board. Identify any receiving waters, into which the developed area would discharge to, listed on the most recent list of Clean Water Act Section 303(d) impaired water bodies[2]. List any and all pollutants for which the receiving waters are impaired. Use Table 2-1 of this SUSMP Manual to list anticipated pollutants based on land use.

---

1. Go to: http://www.waterboards.ca.gov/sandiego/water_issues/programs/303d_list/index.shtml

2. Under Section 303(d) of the 1972 Clean Water Act, states, territories and authorized tribes are required to develop a list of water quality limited segments. These waters on the list do not meet water quality standards, even after point sources of pollution have installed the minimum required levels of pollution control technology. Go to: http://www.swrcb.ca.gov/rwqcb9/water_issues/programs/303d_list/index.shtml. San Diego is in Region 9.

References and Resources

- *Site Planning for Urban Stream Protection* (Schueler 1995).
- *Start at the Source* (BASMAA 1999), p. 36

Step 2: Identify Constraints & Opportunities

Review the information collected in Step 1. Identify the principal constraints on site design and selection of treatment and flow-control facilities as well as opportunities to reduce imperviousness and incorporate facilities into the site and landscape design. For example, **constraints** might include impermeable soils, high groundwater, groundwater pollution or contaminated soils, steep slopes, geotechnical instability, high-intensity land use, heavy pedestrian or vehicular traffic, restricted right-of-way, or safety concerns. **Opportunities** might include existing natural areas, low areas, oddly configured or otherwise unbuildable parcels, easements and landscape amenities including open space and buffers (which can double as locations for bioretention facilities), and differences in elevation (which can provide hydraulic head). Note storm water treatment facilities should not be located within protected riparian areas.

Prepare a brief **narrative** describing site opportunities and constraints. This narrative will help you as you proceed with LID design and explain your design decisions to others.

Step 3: Prepare and Document Your LID Design

Use the Low Impact Development Design Guide (Chapter 4) to analyze your project for LID, design and document drainage, and specify preliminary design details for integrated management practices. **Follow the detailed instructions in Chapter 4 to ensure your project complies with NPDES permit LID requirements (Provision D.1.d.(4)) and storm water treatment requirements in Provision D.1.d.(6)).** The LID Design Guide has been designed so that hydromodification management requirements are also met via this unified design procedure. Chapter 4 includes calculation procedures and formats for presenting your calculations.

As shown in the example checklist (page 47), your Project Submittal may need to include a drawing showing:

- The entire site divided into separate drainage management areas (DMAs), with each area identified as one of the following: self-treating, self-retaining, draining to a self-retaining area, or draining to an IMP. Each area should be clearly marked with a unique identifier.
- For each drainage area, the types of impervious area proposed, and the area of each.

Compliance

The design criteria for DMAs in Chapter 4 ensure the required volume of flow from all developed portions of the project, including landscaped areas, is infiltrated, filtered, or treated (Provision D.1.d.(6)(a).

- Proposed locations and sizes of treatment facilities. Each facility should be clearly marked with a unique identifier.

Your Project Submittal may need to include:

- Tabulation of proposed self-treating areas, self-retaining areas, areas draining to self-retaining areas, and areas draining to IMPs, and the corresponding IMPs identified on the Exhibit.
- Calculations, in the format shown in Chapter 4, showing the minimum square footage required and proposed square footage for each IMP.
- Preliminary designs for each IMP. The design sheets and accompanying drawings in Appendix B may be used or adapted for this purpose.

The following may also be required, or may be advisable to assist the reviewer to understand your design:

- A narrative overview of your design and how your design decisions optimize the site layout, use pervious surfaces, disperse runoff from impervious surfaces, and drain impervious surfaces to engineered IMPs. See Chapter 4.
- A narrative briefly describing each **drainage management area** (DMA), its drainage, and where drainage will be directed.
- A narrative briefly describing each IMP. Include any special characteristics or features distinct from the design sheets in Appendix B.

References and Resources

- Chapter 4
- *County of San Diego Low Impact Development Handbook*
- *The City of National City General Plan*
- *The City of National City Storm Water Management and Discharge Control Ordinance* (Chapter 14.22.010 of the National City Municipal Code)
- *Low Impact Development Manual* (Prince George's County, Maryland, 1999).
- *Bioretention Manual* (Prince George's County, Maryland, rev. 2002)
- *Site Planning for Urban Stream Protection* (Schueler, 1995b).
  Low Impact Development Technical Guidance Manual for Puget Sound (Puget Sound Action Team, 2005)
- *LID for Big Box Retailers* (Low Impact Development Center, 2006)

Step 4. Specify Source Control BMPs

Some everyday activities – such as trash recycling/disposal and washing vehicles and equipment – generate pollutants that tend to find their way into storm drains. These pollutants can be minimized by applying **source control BMPs**.

Source control BMPs include **permanent**, structural features that must be incorporated into your project plans and **operational** BMPs, such as regular sweeping and "housekeeping," that must be implemented by the site's occupant or user. The maximum extent practicable standard typically requires both types of BMPs. In general, operational BMPs cannot be substituted for a feasible and effective permanent BMP.

Use the following procedure to specify source control BMPs for your site:

► **IDENTIFY POLLUTANT SOURCES**

Review the first column in the **Pollutant Sources/Source Control Checklist** (Appendix C). Check off the potential sources of pollutants that apply to your site.

► **NOTE LOCATIONS ON SUBMITTAL DRAWING**

Note the corresponding requirements listed in Column 2 of the Pollutant Sources/Source Control Checklist (Appendix C). Show the location of each pollutant source and each permanent source control BMP in your submittal drawing.

► **PREPARE A TABLE AND NARRATIVE**

Check off the corresponding requirements listed in Column 3 in the Pollutant Sources/Source Control Checklist (Appendix C). Now, create a table using the format in Table 3-1. In the left column, list each potential source on your site (from Appendix C, Column 1). In the middle column, list the corresponding **permanent, structural BMPs** (from Columns 2 and 3, Appendix C) used to prevent pollutants from entering runoff. Accompany this table with a narrative that explains any special features, materials, or methods of construction that will be used to implement these permanent, structural BMPs.

► **IDENTIFY OPERATIONAL SOURCE CONTROL BMPS**

TABLE 3-1. Format for Table of Permanent and Operational Source Control Measures

Potential source of runoff pollutants	*Permanent source control BMPs*	*Operational source control BMPs*

To complete your table, refer once again to the Pollutant Sources/Source Control Checklist (Appendix C, Column 4). List in the right column of your table the operational BMPs that should be implemented as long as the anticipated activities continue at the site. The same BMPs may also be required as a condition of a use permit or other revocable discretionary approval for use of the site.

References and Resources

- Appendix C: Storm Water Pollutant Sources/Source Control Checklist
- RWQCB Order R9-2007-0001, Provision D.1.d.(5)
- *Start at the Source*, Section 6.7: Details, Outdoor Work Areas
- *California Stormwater Industrial/Commercial Best Management Practice Handbook*
- *Urban Runoff Quality Management* (WEF/ASCE, 1998) Chapter 4: Source Controls

Step 5: Storm Water Facility Maintenance

As required by NPDES Permit Provision D.1.c.(5), projects that include permanent BMPs shall be conditioned to require submittal of proof of a mechanism under which ongoing long-term maintenance of storm water treatment and flow-control facilities will be conducted, satisfactory to the City of National City. Note that treatment facilities include both IMPs and treatment control BMPs. The City of National City requires the following items be included in your Project Submittal:

1. A means to finance and implement facility maintenance in perpetuity.
2. Acceptance of responsibility for maintenance from the time the facilities are constructed until responsibility for operation and maintenance is legally transferred. A warranty covering a period following construction may also be required.
3. An outline of general maintenance requirements for the treatment and flow-control facilities you have selected.

The City of National City may also require that you prepare and submit a detailed plan that sets forth a maintenance schedule for each of the treatment and flow-control facilities built on your site.

Details of these requirements, and instructions for preparing a detailed operation and maintenance plan, are in Chapter 5.

References and Resources

- *Chapter 5*
- Operation, Maintenance, and Management of Stormwater Management Systems (Watershed Management Institute, 1997)

Step 6: Complete Your Project Submittal

City staff may provide specific instructions for the content and format of your Project Submittal. Your Project Submittal should document the information gathered and decisions made in Steps 1-5. A clear, complete, well-organized Project Submittal will make it possible to confirm your design meets the minimum requirements of the NPDES permit, the City of National City Storm Water Ordinance, and this SUSMP Manual.

► COORDINATION WITH SITE, ARCHITECTURAL, AND LANDSCAPING PLANS

Before completing your Project Submittal, ensure your storm water control design is fully coordinated with the site plan, grading plan, and landscaping plan being proposed for the site.

Information submitted and presentations to design review committees, planning commissions, and other decision-making bodies must incorporate relevant aspects of the storm water design. In particular, ensure:

- Curb elevations, elevations, grade breaks, and other features of the drainage design are consistent with the delineation of DMAs.
- The top edge (overflow) of each bioretention facility is level all around its perimeter—this is particularly important in parking lot medians.
- The resulting grading and drainage design is consistent with the design for parking and circulation.
- Bioretention facilities and other IMPs do not create conflicts with pedestrian access between parking and building entrances.
- Vaults and utility boxes can be accommodated outside bioretention facilities and will not be placed within bioretention facilities.
- The visual impact of storm water facilities, including planter boxes at building foundations and any terracing or retaining walls required for the storm water control design, is shown in renderings and other architectural drawings.
- Landscaping plans, including planting plans, show locations of bioretention facilities, and the plant requirements are consistent with the engineered soils and conditions in the bioretention facilities.
- Renderings and representation of street views incorporate any storm water facilities located in street-side buffers and setbacks

► CONSTRUCTION PLAN SUSMP CHECKLIST

When you submit construction plans for City review and approval, the reviewer will compare that submittal with your earlier Project Submittal. By creating a Construction Plan SUSMP Checklist for your project, you can facilitate the reviewer's comparison and speed review of your project.

TABLE 3-2. Format for Construction Plan SUSMP Checklist

SUSMP Page #	*BMP Description*	*See Plan Sheet #s*

Here's how:

4. Create a table similar to Table 3-2. Number and list each measure or BMP you have specified in your Project Submittal in Columns 1 and 2 of the table. Leave Column 3 blank. Incorporate the table into your Project Submittal.

5. When you submit construction plans, **duplicate the table** (by photocopy or electronically). Now fill in Column 3, identifying the plan sheets where the BMPs are shown. List all plan sheets on which the BMP appears. Submit the updated table with your construction plans.

Note that the updated table—or Construction Plan SUSMP Checklist—is **only a reference tool** to facilitate comparison of the construction plans to your Project Submittal. City staff can advise you regarding the process required to propose changes to your approved Project Submittal.

► CERTIFICATION

Your Project Submittal shall be certified by a registered civil engineer.

The certification should state: "The selection, sizing, and preliminary design of storm water treatment and other control measures in this plan meet the requirements of Regional Water Quality Control Board Order R9-2007-0001 and subsequent amendments."

► EXAMPLE PROJECT SUBMITTAL OUTLINE AND CONTENTS

Check with City staff for requirements specific to your project.

I. Project Setting

- A. Project Name, Location, Description of project activities
- B. Vicinity Map
- C. Existing site features and conditions
- D. Opportunities and constraints for storm water control
- E. Watershed(s), receiving water bodies, and water body impairments
- F. Pollutants of concern based on land use and downstream water body impairments
- G. Impacts to hydrologic regime

II. Low Impact Development Design Strategies

- A. Optimization of site layout
  - (1) Limitation of development envelope
  - (2) Preservation of natural drainage features
  - (3) Setbacks from creeks, wetlands, and riparian habitats
  - (4) Minimization of imperviousness
  - (5) Using drainage as a design element
- B. Use of permeable pavements
- C. Dispersal of runoff to pervious areas
- D. Use of Integrated Management Practices

III. Hydromodification Analysis

- A. Hydromodification Applicability
- B. Flow Control Performance Criteria

IV. Documentation of Drainage Design

- A. Drainage Management Areas
  - (1) Tabulation

(2) Descriptions

B. Integrated Management Practices

(1) Tabulation and Sizing Calculations

(2) Descriptions

V. Source Control Measures

A. Description of site activities and potential sources of pollutants

B. Table showing sources, permanent source controls, and operational source controls

VI. Facility Maintenance Requirements

A. Ownership and responsibility for maintenance in perpetuity.

(1) Commitment to execute any necessary agreements.

(2) Statement accepting responsibility for operation and maintenance of facilities until that responsibility is formally transferred.

B. Summary of maintenance requirements for each storm water facility.

VII. Construction Plan SUSMP Checklist

VIII. Certifications

IX. Attachment: SUSMP Exhibit (Site Map) clearly showing:

A. Entire property

B. Nearby water bodies and municipal storm drain inlets

C. Private storm drain systems

D. Drainage Management Areas

E. Integrated Management Practices

F. Source control measures and potential sources of pollutants

G. Any other proposed BMPs

► SPECIFIC PROJECT CONSIDERATIONS

Your submittal will reflect the unique character of your own project and should meet the requirements identified in this SUSMP Manual. City staff can assist you to determine how specific requirements apply to your project.

Chapter

4

Low Impact Development Design Guide

Guidance for designing and documenting your LID site drainage, storm water treatment facilities, and flow-control facilities

Follow the Low Impact Development (LID) design in this BMP manual to achieve compliance with the storm water treatment requirements as well as the LID requirements in the storm water NPDES permit. The City of National City encourages the use of the design and documentation strategies outlined in this chapter. While other approaches may be used, they must be defensibly shown by the project proponent to meet or exceed the standards in this SUSMP Manual.

This will require careful documentation of:

- Pervious and impervious areas in the planned project.
- Drainage from each of these areas.
- Locations, sizes, and types of proposed treatment facilities.

Your Project Submittal must include calculations showing the site drainage and proposed LID treatment facilities meet the criteria in this SUSMP Manual.

This Low Impact Development Design Guide will help you:

- **Analyze your project** and identify and select options for implementing LID techniques to meet runoff treatment requirements—and flow-control requirements, if they apply.
- **Design and document drainage** for the whole site and document how that design meets this SUSMP Manual's storm water treatment criteria.
- **Specify preliminary design details** and integrate your LID drainage design with your paving and landscaping design.

Alternatives to LID design are discussed in the final section of this chapter.

Analyze Your Project for LID

Conceptually, there are four LID strategies for managing runoff from buildings and paving:

1. **Optimize the site layout** by preserving natural drainage features and designing buildings and circulation to minimize the amount of roofs and paving.

2. **Use pervious surfaces** such as turf, gravel, or pervious pavement—or use surfaces that retain rainfall, such as vegetated roofs. All drainage from these surfaces is considered to be "self-retained" (a detailed definition corresponding to this concept is on page 67). No further management of runoff is necessary. An emergency overflow should be provided for extreme events.

3. **Disperse runoff** from impervious surfaces on to adjacent pervious surfaces (e.g., direct a roof downspout to disperse runoff onto a lawn).

4. Drain impervious surfaces to engineered **Integrated Management Practices** (IMPs), such as bioretention facilities, planter boxes, cisterns, or dry wells. IMPs infiltrate runoff to groundwater and/or percolate runoff through engineered soil and allow it to drain away slowly. Depending on site conditions and local regulations, it may be possible to harvest and reuse rainwater in conjunction with IMPs.

A combination of two or more strategies may work best for your project. With forethought in design, the four strategies can provide multiple, complementary benefits to your development. Pervious surfaces reduce heat island effects and temperature extremes. Landscaping improves air quality, creates a better place to live or work, and upgrades value for rental or sale. Retaining natural hydrology helps preserve and enhance the natural character of the area. LID drainage design can also conserve water and reduce the need for drainage infrastructure.

Table 4-1 includes ideas for applying LID strategies to site conditions and types of development.

TABLE 4-1. Ideas for Runoff Management

Site Features and Design Objectives	Vegetated Roof	Self-retaining Areas	Pervious Pavement	Bioretention Facility	Flow-through Planter	Dry Well	Cistern with bioretention
Clayey native soils	✓			✓	✓		✓
Permeable native soils	✓		✓	✓	✓	✓	
Very steep slopes	✓				✓		
Shallow groundwater	✓				✓		
Avoid saturating subsurface soils	✓		✓		✓		
Connect to roof downspouts		✓		✓	✓	✓	✓
Parking lots/islands and medians			✓	✓		✓	
Sites with extensive landscaping		✓	✓	✓			
Densely developed sites with limited space/landscape	✓		✓		✓	✓	✓
Fit IMPs into landscape and setback areas				✓			✓
Make drainage a design feature		✓		✓			✓
Convey as well as treat storm water				✓			

► **OPTIMIZE THE SITE LAYOUT**

To minimize storm water-related impacts, apply the following design principles to the layout of newly developed and redeveloped sites.

Conserve natural areas, soils, and vegetation. Define the development envelope and protected areas, identifying areas that are most suitable for development and areas that should be left undisturbed. Use the following guideline to determine the least sensitive areas of the site, in order of increasing sensitivity:

1. Areas devoid of vegetation, including previously graded areas and agricultural fields.
2. Areas of non-native vegetation, disturbed habitats, and eucalyptus woodlands where receiving waters are not present.
3. Areas of chamise or mixed chaparral, and non-native grasslands.
4. Areas containing coastal scrub communities.
5. All other upland communities.
6. Occupied habitat of sensitive species and all wetlands.

Within each of the previous categories, hillside areas should be considered more sensitive than flatter areas.

Coordination

Chapter One includes a presentation of how review of your project's site design and landscape design is coordinated with review for compliance with storm water NPDES requirements.

Where possible, conform the site layout along natural landforms, avoid excessive grading and disturbance of vegetation and soils, and replicate the site's natural drainage patterns. Set back development from creeks, wetlands, and riparian habitats. Preserve significant trees, especially native trees and shrubs, and identify locations for planting additional native or drought tolerant trees and large shrubs. Concentrate development on portions of the site with less permeable soils, and preserve areas that can promote infiltration.

For all types of development, **limit overall coverage** of paving and roofs. Where allowed by National City zoning and design standards—and provided public safety and a walkable environment are not compromised—this can be accomplished by designing compact, taller structures, narrower and shorter streets and sidewalks, smaller parking lots (fewer stalls, smaller stalls, and more efficient lanes), and indoor or underground parking. Examine site layout and circulation patterns and identify areas where landscaping can be substituted for pavement.

Detain and retain runoff throughout the site. On flatter sites, it typically works best to intersperse landscaped areas and IMPs among the buildings and paving. On hillside sites, drainage from upper areas may be collected in conventional catch basins and piped to landscaped areas and IMPs in lower areas.

Use drainage as a design element. Use depressed landscape areas, vegetated buffers, and bioretention areas as amenities and focal points within the site and landscape design. Bioretention areas can be almost any shape and should be located at low points. Bioretention areas shaped as swales can detain and treat low runoff flows and also convey higher flows.

► USE PERVIOUS SURFACES

Consider a vegetated roof. Although not yet widely used in California, vegetated or "green" roofs are growing in popularity. Potential benefits include longer roof life, lower heating and cooling costs, and better sound insulation, in addition to air quality and water quality benefits. For SUSMP compliance purposes, vegetated roofs are considered not to produce increased runoff or runoff pollutants (i.e., any runoff from a vegetated roof requires no further treatment or detention). For more information on vegetated roofs, see www.greenroofs.org.

Consider permeable pavements and surface treatments. Inventory paved areas on your preliminary site plan. Identify where permeable pavements, such as crushed aggregate, turf block, unit pavers, pervious concrete, or pervious asphalt could be substituted for impervious concrete or asphalt paving.

► DISPERSE RUNOFF TO ADJACENT PERVIOUS AREAS

Look for opportunities to direct runoff from impervious areas to adjacent landscaping. The design, including slopes and soils, must reflect a reasonable expectation that an inch of rainfall will soak into the soil and produce no runoff. For example, a lawn or garden depressed 3-4" below surrounding walkways or driveways provides a simple but functional landscape design element.

For sites subject to storm water treatment requirements only, a 2:1 maximum ratio of impervious to pervious area is acceptable. Be sure soils will drain adequately.

Under some circumstances, it may be allowable to direct runoff from impervious areas to pervious pavement (for example, from roof downspouts to a parking lot paved with crushed aggregate or turf block). The pore volume of pavement and base course must be sufficient to retain an inch of rainfall, including runoff from the tributary area. The slopes and soils must be compatible with infiltrating that volume without producing runoff.

► DIRECT RUNOFF TO INTEGRATED MANAGEMENT PRACTICES

Design criteria have been developed for the following IMPs:

- **Bioretention facilities**, which can be configured as swales, free-form areas, or planters to integrate with your landscape design.
- **Flow-through planters**, which can be used near building foundations and other locations where infiltration to native soils is not desired.
- **Dry wells** and other infiltration facilities, which can be used only where soils are permeable.
- **Cisterns or vaults**, in combination with a bioretention facility.

See the design sheets in Appendix B.

It may be possible to create a site-specific design that uses cisterns to achieve storm water flow control, storm water treatment, and rainwater reuse for irrigation or indoor uses (**water harvesting**). Such a design could expand the multiple benefits of LID to include water conservation. Keep in mind:

- Facilities must meet criteria for capturing and treating the volume specified by Equation 4-8 below. This volume must be allowed to empty within 24 hours so runoff from additional storms, which may follow, is also captured and treated. Additional volume may be required if the system also stores runoff for longer periods for reuse.

- Storage of water for longer than minimum standards set forth by local jurisdictions (96 hours for County Department of Environmental Health) creates the potential for mosquito harborage. Cisterns and vaults must be designed to prevent entry by mosquitoes.

- Indoor uses of non-potable water may be restricted or prohibited. Check with City staff.

Some references and resources for water harvesting appear at the end of this chapter.

Finding the right location for treatment facilities on your site involves a careful and creative integration of several factors:

- To make the most efficient use of the site and to maximize aesthetic value, **integrate IMPs with site landscaping**. Zoning codes may require landscape setbacks or buffers, or may specify that a minimum portion of the site be landscaped. It may be possible to locate some or all of your site's treatment and flow-control facilities within this same area, or within utility easements or other non-buildable areas.

- Planter boxes and bioretention areas must be **level or nearly level** all the way around. Bioretention areas configured as swales may be gently sloped in the linear direction, but opposite sides must be at the same elevation.

- For effective, low-maintenance operation, **locate facilities so drainage into and out of the device is by gravity flow.** Pumped systems are feasible, but are expensive, require more maintenance, are prone to untimely failure, and can cause mosquito control problems.

- If the property is being subdivided now or in the future, the facility should be in a **common, accessible area.** In particular, avoid locating facilities on private residential lots. Even if the facility will serve only one site owner or operator, make sure the facility is located for ready access by inspectors from the City of National City and local vector control agency.

- The facility must be accessible to equipment needed for its maintenance. **Access requirements for maintenance** will vary with the type of facility selected. Planter boxes and bioretention areas will typically need access for the same types of equipment used for landscape maintenance.

To complete your analysis, include in your Project Submittal a brief **narrative** documenting the site layout and site design decisions you made. This will provide background and context for how your design meets the quantitative LID design criteria.

Develop and Document Your Drainage Design

The **design documentation procedure** begins with careful delineation of pervious areas and impervious areas (including roofs) throughout the site. The procedure accounts for how runoff from each delineated area is managed. For areas draining to IMPs, the procedure ensures each IMP is appropriately sized.

The procedure results in a space-efficient, cost-efficient LID design for meeting SUSMP requirements on most residential and commercial/industrial developments. The procedure arranges documentation of drainage design and IMP sizing in a consistent format for presentation and review.

This procedure is intended to facilitate, not substitute for, creative interplay among site design, landscape design, and drainage design. **Several iterations may be needed** to optimize your drainage design as well as aesthetics, circulation, and use of available area for your site.

You should be able to complete the needed calculations using only the project's site development plan.

► STEP 1: DELINEATE DRAINAGE MANAGEMENT AREAS

This is the key first step. You must divide the **entire project area** into individual, discrete Drainage Management Areas (DMAs). Typically, lines delineating DMAs follow grade breaks and roof ridge lines. The Exhibit, tables, text, and calculations in your Project Submittal will illustrate, describe, and account for runoff from each of these areas.

Use separate DMAs for each surface type (e.g., landscaping, pervious paving, or roofs). Each DMA must be assigned a single hydrologic soil group. Assign each DMA an identification number and determine its size in square feet.

► STEP 2: CLASSIFY DMAS AND DETERMINE RUNOFF FACTORS

Next, determine how drainage from each DMA will be handled. Each DMA will be one of the following four types:

1. Self-treating areas.
2. Self-retaining areas (also called "zero-discharge" areas).
3. Areas that drain to self-retaining areas.
4. Areas that drain to IMPs.

Self-treating areas are landscaped or turf areas that do not drain to IMPs, but rather drain directly off site or to the storm drain system. Examples include upslope undeveloped areas which are ditched and drained around a development and grassed slopes which drain off-site to a street or storm drain. In general, self-treating areas include no impervious areas, unless the impervious area is very small (5 percent or less) in relationship to the receiving pervious area and slopes are gentle enough to ensure runoff will be absorbed into the vegetation and soil. Criteria for self-treating areas are in the design sheet "Self Treating and Self-Retaining Areas" in Appendix B.

Rationale

Pollutants in rainfall and windblown dust will tend to become entrained in the vegetation and soils of landscaped areas, so no additional treatment is needed. It is assumed the self-treating landscaped areas will produce runoff less than or equal to the pre-project site condition.

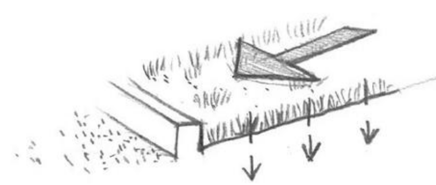


FIGURE 4-1. Self-treating areas are entirely pervious and drain directly off-site or to the storm drain system.

Self-retaining areas are designed to retain the first one inch of rainfall without producing any runoff. The technique works best on flat, heavily landscaped sites. It may be used on mild slopes if there is a reasonable expectation that a one-inch rainfall event would produce no runoff.

To create self-retaining turf and landscape areas in flat areas or on terraced slopes, berm the area or depress the grade into a concave cross-section so that these areas will retain the first inch of rainfall. Specify slopes, if any, toward the center of the pervious area. Inlets of area drains, if any, should be set 3 inches above the low point to allow ponding.

Criteria for self-retaining areas are in the design sheet "Self Treating and Self-Retaining Areas" in Appendix B.

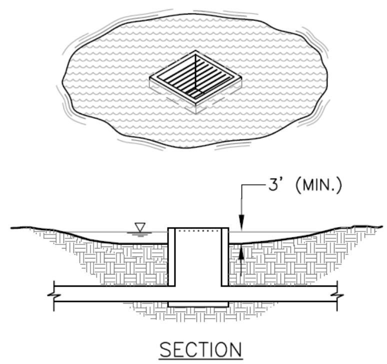


FIGURE 4-2. Self-retaining areas. Berm or depress the grade to retain at least an inch of rainfall and set inlets of any area drains at least 3 inches above low point to allow ponding.

Areas draining to self-retaining areas. Runoff from impervious or partially pervious areas can be managed by routing it to self-retaining pervious areas. For example, roof downspouts can be directed to lawns, and driveways can be sloped toward landscaped areas. The maximum ratio is 2 parts impervious area for every 1 part pervious area.

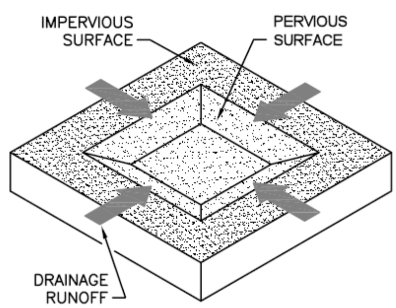


FIGURE 4-3. Relationship of impervious to pervious area for self-retaining areas.
Ratio: ***pervious ≥ ½ impervious***

The drainage from the impervious area must be directed to and dispersed within the pervious area, and the entire area must be designed to retain an inch of rainfall without flowing off-site. For example, if the maximum ratio of 2 parts impervious area into 1 part pervious area is used, then the pervious area must absorb 3 inches of water over its surface before over-flowing to an off-site drain.

A partially pervious area may be drained to a self-retaining area. For example, a driveway composed of unit pavers may drain to an adjacent lawn. In this case, the maximum ratios are:

(Runoff factor) x (tributary area) $\leq$ 2 x (self-retaining area) *Equation 4-1*

Use the runoff factors in Table 4-2.

Prolonged ponding is a potential problem at higher impervious/pervious ratios. In your design, ensure that the pervious area soils can handle the additional run-on and are sufficiently well-drained.

Under some circumstances, pervious pavement (e.g., crushed stone, pervious asphalt or pervious concrete) can be self-retaining. Adjacent roofs or impervious pavement may drain on to the pervious pavement in the same maximum ratios as described above.

To design a pervious pavement to be a self-treating area, ensure:

- The gravel base course is a minimum of four or more inches deep.
- The base course is not to be underdrained.
- A qualified engineer has been consulted regarding infiltration rates, pavement stability, and suitability for the intended traffic.

Runoff from self-treating and self-retaining areas does not require any further treatment or flow control.

TABLE 4-2. Example Runoff Factors for Surfaces Draining to IMPs

Surface	**Factor**
Roofs	1.0
Concrete	1.0
Pervious Concrete	0.1
Porous Asphalt	0.1
Grouted Unit Pavers	1.0
Solid Unit Pavers on granular base, min. 3/16 inch joint space	0.2
Crushed Aggregate	0.1
Turfblock	0.1
Amended, mulched soil	0.1
Landscape	0.1

Areas draining to IMPs are multiplied by a sizing factor to calculate the required size of the IMP. On most densely developed sites—such as commercial and mixed-use developments and small-lot residential subdivisions—most DMAs will drain to IMPs.

More than one drainage area can drain to the same IMP. However, because the minimum IMP sizes are determined by ratio to drainage area size, a drainage area may not drain to more than one IMP. See Figures 4-4 and 4-5.

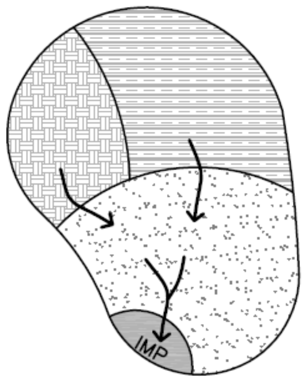


FIGURE 4-4. More than one Drainage Management Area can drain to a single IMP.

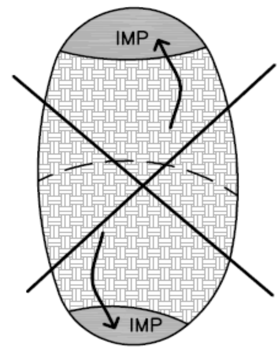


FIGURE 4-5. One Drainage Management Area cannot drain to more than one IMP. Use a grade break to divide the DMA.

Where possible, design site drainage so **only impervious roofs and pavement** drain to IMPs. This yields a simpler, more efficient design and also helps protect IMPs from becoming clogged by sediment.

If it is necessary to include turf, landscaping, or pervious pavements within the area draining to an IMP, list each surface as a separate DMA. A runoff factor (similar to a "C" factor used in the rational method) is applied to account for the reduction in the quantity of runoff. For example, when a turf or landscaped drainage management area drains to an IMP, the resulting increment in IMP size is:

$$\Delta \text{ (Area)} = \text{(pervious area)} \times \text{(runoff factor)} \times \text{(sizing factor)}.$$

Use the runoff factors in Table 4-2.

► STEP 3: TABULATE DRAINAGE MANAGEMENT AREAS

- Tabulate self-treating areas in the format shown in Table 4-3.
- Tabulate self-retaining areas in the format shown in Table 4-4.
- Tabulate areas draining to self-retaining areas in the format shown in Table 4-5. Check to be sure the total product of (square feet of tributary area × runoff factor) for all DMAs draining to a receiving self-retaining area is no greater than a 2:1 ratio to the square footage of the receiving self-retaining area itself.

- Compile a list of DMAs draining to IMPs. Proceed to Step 4 to check the sizing of the IMPs.

TABLE 4-3. Format for Tabulating Self-Treating Areas

DMA Name	Area (square feet)

TABLE 4-4. Format for Tabulating Self-Retaining Areas

DMA Name	Area (square feet)

TABLE 4-5. Format for Tabulating Areas Draining to Self-Retaining Areas

DMA Name	Area (square feet)	Post-project surface type	Runoff factor	Receiving self-retaining DMA	Receiving self-retaining DMA Area (square feet)

► STEP 4: SELECT AND LAY OUT IMPS ON SITE PLAN

Select from the list of IMPs in Table 4-6. Illustrations, designs, and design criteria for the IMPs are in the "IMP Design Details and Criteria" at the end of this chapter.

Once you have laid out the IMPs, calculate the square footage you have set aside on your site plan for each IMP.

► STEP 5: REVIEW SIZING FOR EACH IMP

For each of the IMPs, use the appropriate "water quality only" sizing factor from Table 4-6. Sizing for integrated facilities that provide both water quality treatment and hydromodification flow control can be performed using the regional BMP Sizing Calculator. Contact the City's Development Services Department for the appropriate regionally adopted sizing factors.

TABLE 4-6. "Water Quality Only" Sizing Factors

Bioretention Facilities	Sizing Factor for Area = 0.04
Flow-through Planters	Sizing Factor for Area = 0.04
Dry Well or Infiltration Basin	See Step 6 to Calculate Min. Volume
Cistern/Vault with Bioretention	See Step 6 to Calculate Min. Volume of Cistern or Vault; then use 0.04 to calculate minimum size of bioretention area

► STEP 6: CALCULATE MINIMUM AREA AND VOLUME OF EACH IMP

The minimum area of bioretention facilities and flow-through planters is found by summing up the contributions of each tributary DMA and multiplying by the adjusted sizing factor for the IMP. Note that if the IMP is designed to provide hydromodification flow control, then the regional BMP Sizing Calculator should be used where possible. Separate sizing factors available from the City's Development Services Department should be used in lieu of the "water quality only" sizing factors presented in Table 4-6.

Equation 4-7

$$Min.\ IMP\ Area = \sum \begin{pmatrix} DMA & & DMA \\ Square & \times & Runoff \\ Footage & & Factor \end{pmatrix} \times \begin{pmatrix} IMP \\ Sizing \\ Factor \end{pmatrix}$$

Use the format of Table 4-7 to present the calculations of the required minimum area and volumes for **bioretention areas** and **planter boxes**:

TABLE 4-7. Format for Presenting Calculations of Minimum IMP Areas for Bioretention Areas and Planter Boxes

DMA Name	DMA Area (square feet)	Post-project surface type	DMA Runoff factor	DMA Area × runoff factor	Soil Type:	IMP Name			
					IMP Sizing factor (WQ only)		Minimum Area	Proposed Area	
			Total		***0.04***				***IMP Area***

To size **dry wells**, **infiltration basins**, or **infiltration trenches for the "water quality only" treatment option**, use the following procedure:

1. Use the County of San Diego's 85th Percentile Isopluvial Map to determine the minimum unit volume.
2. Determine the weighted runoff factor ("C" factor) for the area tributary to the facility. The factors in Table 4-2 may be used.
3. Multiply the weighted runoff factor times the tributary area times the minimum unit volume.

Equation 4-8

$$Volume = [Tributary\ Area] \times [weighted\ runoff\ factor] \times [unit\ volume]$$

4. Select a facility depth.
5. Determine the required facility area. Dry wells may be designed as an open vault or with rock fill. If rock fill is used, assume a porosity of 40%.
6. Ensure the facility can infiltrate the entire volume within the minimum drawdown time as determined by the City.

To size a **cistern or vault in series with a bioretention facility (criteria below for "water quality only" treatment option)**:

1. Use Equation 4-8 to calculate the required cistern or vault volume.
2. Design a discharge orifice for a drawdown time of 24 hours.
3. Determine the maximum discharge from the orifice.
4. The minimum area of the bioretention facility must treat this flow based on a percolation rate of 5" per hour through the engineered soil.

If a facility is designed to provide both water quality treatment and hydromodification flow control, then the regional BMP Sizing Calculator should be used where possible. Otherwise, refer to the City's Development Services Department to determine the appropriate sizing factors for IMP design, based on regional standards developed by the Copermittees.

► STEP 7: DETERMINE IF AVAILABLE SPACE FOR IMP IS ADEQUATE

Sizing and configuring IMPs may be an iterative process. After computing the minimum IMP area using Steps 1 – 6, review the site plan to determine if the reserved IMP area is sufficient. If so, the planned IMPs will meet the SUSMP sizing requirements. If not, revise the plan accordingly. Revisions may include:

- Reducing the overall imperviousness of the project site.
- Changing the grading and drainage to redirect some runoff toward other IMPs which may have excess capacity.
- Making tributary landscaped DMAs self-treating or self-retaining.
- Expanding IMP surface area.

► STEP 8: COMPLETE YOUR SUMMARY REPORT

Present your IMP sizing calculations in tabular form. Adapt the following format as appropriate to your project. Coordinate your presentation of DMAs and calculation of minimum IMP sizes with the Project Submittal drawing (labeled to show delineation of DMAs and locations of IMPs). It is also helpful to incorporate a brief description of each DMA and each IMP.

Sum the total area of all DMAs and IMPs listed and show it is equal to the total project area. This step may include adjusting the square footage of some DMAs to account for area used for IMPs.

Format:

Project Name:

Project Location:

APN or Subdivision Number:

Total Project Area (square feet):

Mean Annual Precipitation at Project Site:

I. Self-treating areas:

DMA Name	**Area (square feet)**

II. Self-retaining areas:

DMA Name	**Area (square feet)**

III. Areas draining to self-retaining areas:

DMA Name	**Post-project surface type**	**Runoff factor**	**Area (square feet)**	**Receiving self-retaining DMA**	**Receiving self-retaining DMA Area (square feet)**

IV. Areas draining to IMPs (repeat for each IMP):

DMA Name	DMA Area (square feet)	Post-project surface type	DMA Runoff factor	DMA Area × runoff factor
			Total	

Soil Type:	IMP Name

IMP Sizing factor		Minimum Area or Volume	Proposed Area or Volume	
				IMP Area

Specify Preliminary Design Details

In your Project Submittal, describe your IMPs in sufficient detail to demonstrate the area, volume, and other criteria of each can be met within the constraints of the site.

Ensure these details are consistent with preliminary site plans, landscaping plans, and architectural plans submitted with your application for planning and zoning approvals.

Appendix B includes design sheets for:

- Self-treating and self-retaining areas
- Pervious pavements
- Bioretention facilities
- Flow-through planter
- Dry wells and infiltration basins
- Cistern or vault with bioretention facility

These design sheets include recommended configurations and details, and example applications, for these IMPs. **The information in these design sheets must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head. Designated City staff have final review and approval authority over the project design.**

Keep in mind that proper and functional design of the IMP is the responsibility of the applicant. Effective operation of the IMP throughout the project's lifetime will be the responsibility of the property owner.

Alternatives to Integrated LID Design

If you believe design of features and facilities as described above is infeasible for your development site, consult with City staff before preparing an alternative design for storm water treatment, flow control, and LID compliance.

For all alternative designs, the applicant must prepare a complete Project Submittal, which may include a drawing showing the entire site divided into discrete Drainage Management Areas, text and tables showing how drainage is routed from each DMA to a treatment facility, and calculations demonstrating that the design achieves the applicable design criteria for each storm water treatment facility. Alternative treatment facilities are limited to the circumstances and selection criteria identified beginning on page 38. The Project Submittal must also show how the project meets the minimum LID criteria (page 42) and ensures runoff rates, durations, and velocities are controlled to maintain or reduce downstream erosion conditions and protect stream habitat (NPDES Permit Provision D.1.d.(10)).

► DESIGN OF ALTERNATIVE TREATMENT FACILITIES

Here are criteria and design considerations for some alternative treatment facilities, also known as treatment control BMPs:

Sand Filters. To ensure effectiveness is not compromised by compacting or clogging of the filter surface, sand filters must be maintained frequently.

The following criteria apply to sand filters:

- Calculate the design flow using the rational method with an intensity of 0.2"/hour and the "C" factors for "treatment only" from Table 4-2.
- To determine the required filter surface area, divide the design flow by an allowable design surface loading rate of 5"/hour.
- The minimum depth of filter media is 18". The media should be washed sand, with gradation similar to that specified for fine aggregate in ASTM C-33.
- The entire filter area must be accessible for easy maintenance without the need to enter a confined space.

A typical filter design includes a gravel drain layer and a perforated pipe underdrain. Filter fabric may be used to prevent the filter media from entering the gravel layer.

The design should not include any permanent pool or other standing water. Instead of including a pretreatment basin, consider the following features in the area tributary to the filter to reduce the potential for filter clogging:

- Limit the size of the Drainage Management Area.

- Include only impervious areas in the DMA.
- Stabilize slopes and eliminate sources of sediment in the DMA.
- Provide screens for trash and leaves at storm drain inlets (if allowed by the City of National City).

For additional design considerations and details, see *Design of Stormwater Filtering Systems* by Richard A. Claytor and Thomas R. Schueler, The Center for Watershed Protection, 1996, and *California Stormwater BMP Handbooks* Fact Sheet TC-40, Media Filter.

Sand filters do not provide adequate hydromodification flow controls.

Extended ("Dry") Detention Basins. The required detention volume for water quality treatment is based on the 85th percentile 24-hour storm depth. The steps to calculate the required detention volume are:

1. Use the County of San Diego's 85th Percentile Isopluvial Map to determine the unit basin volume.
2. Determine the weighted runoff factor ("C" factor) for the area tributary to the basin. The factors in Table 4-2 may be used.
3. Multiply the weighted runoff factor times the tributary area times the unit basin volume.

For maximum effectiveness the basin should not be sized substantially larger than this volume. If the basin is to be used for hydromodification flow control, then the BMP Sizing Calculator pond sizer or a continuous simulation model must be used to prove the basin meets peak flow and flow duration criteria.

For design considerations and details, see the *California Stormwater Best Management Practice Handbooks*, Fact Sheet TC-22, "Extended Detention Basins." The basin outlet should be designed for a drawdown time that does not exceed the City's maximum required drawdown time.

As noted in Fact Sheet TC-22, "dry" detention basins may not be practicable for drainage areas less than 5 acres. The potential for mosquito harborage is a concern. In the design, do not create any areas that will hold standing water for time periods in excess of the maximum vector control detention time (96 hours for the County of San Diego). The City reserves the right to require a shorter drawdown time where deemed necessary.

"Wet" Detention Ponds and Constructed Wetlands. The required water quality detention volume is determined as with a "dry" detention basin. Before proceeding with design, contact the local vector control agency to coordinate the design and plan ongoing inspection and maintenance of the facility for vector control. For design considerations and details, see the *California Stormwater Best Management Practices Handbooks*, Fact Sheet TC-20, "Wet Ponds," and Fact Sheet TC-21, "Constructed Wetlands."

Vegetated Swales. Design recommendations for conventional vegetated swales are in the *California Stormwater Best Management Practices Handbooks*. The conventional swale design uses available on-site soils and does not include an underdrain system. Where soils are clayey, there is little infiltration. Treatment occurs as runoff flows through grass or other vegetation before exiting at the downstream end. Recommended detention times are on the order of 10 minutes. It should be noted that such designs would not provide the benefit of hydromodification flow control.

Conventional vegetated swales may be used to meet NPDES permit treatment requirements and LID requirements (see page 38). The following should be incorporated in the design:

- Determine the weighted runoff factor ("C" factor) for the area tributary to the swale. The factors in Table 4-2 may be used.
- Calculate the design flow by multiplying the weighted runoff factor times the tributary area times either (1) 0.2 inches of rainfall per hour, or (2) twice the 85th percentile hourly rainfall intensity.
- When sizing the swale, use a value of 0.25 for Manning's "n."
- Ensure that all flow enters the swale near its highest point and that no flow short-circuits treatment by entering the swale along its length.
- The swale should be a minimum 100 feet in length.
- Longitudinal slopes should not exceed 2.5%; on flatter slopes, incorporate measures to avoid prolonged surface ponding.

Consider using linear-shaped bioretention areas (see Appendix B) in place of conventional vegetated swales because:

- Conventional swale design has resulted in standing water and associated nuisances.
- Conventional swales often don't obtain even the design residence time because of the length required and because proper design requires runoff enter the swale at the upstream end rather than at various locations along its length, and
- Bioretention areas provide a more flexible drainage design, more effective practicable treatment, and more effective flow control within the same footprint.

In the western part of San Diego County (west of the Pacific Ocean drainage divide), rock swales would not generally provide adequate water quality treatment. In the eastern portion of the County, rock swales could potentially be used as part of the water quality treatment design given the prevalence of high-infiltration sandy soils and the harsh climatic conditions which prevent vegetation establishment. Implementation of rock swales requires approval from the City. The design of vegetated strips, potentially allowed by the City on a case-by-case basis, should follow Caltrans design guidance.

► TREATMENT FACILITIES FOR SPECIAL CIRCUMSTANCES

Higher-rate surface filters and vault-based proprietary filters can only be used in the circumstances described beginning on page 38 and when sand filters, extended "dry" detention basins, and "wet" detention ponds or constructed wetlands have been found infeasible.

For surface filters, the grading and drainage design should minimize the area draining to each unit and maximize the number of discrete drainage areas and units. Proprietary facilities should be installed consistent with the manufacturer's instructions.

Such facilities do not provide hydromodification flow control.

References and Resources:

- RWQCB Order R9-2007-0001 (Storm Water NPDES Permit)
- Low Impact Development Center
- *County of San Diego Low Impact Development Handbook*
- *California Best Management Practices Handbooks*
- *Design of Stormwater Filtering Systems* (Claytor and Schueler, 1996)
- American Rainwater Catchment Systems Association
- Water Conservation Alliance of Southern Arizona
- *Rainwater Harvesting for Drylands and Beyond*
- *The Texas Manual on Rainwater Harvesting*
- *Managing Wet Weather With Green Infrastructure: Municipal Handbook, Rainwater Harvesting Policies* (Low Impact Development Center, 2008)

Chapter

5

Operation & Maintenance of Storm Water Facilities

How to prepare a customized Storm Water Maintenance Plan for the treatment BMPs on your site.

The storm water NPDES Permit requires the City of National City to verify all treatment and flow-control facilities are adequately maintained. Note that treatment facilities include IMPs and treatment control BMPs. Facilities you install as part of your project will be verified for effectiveness and proper performance. The City of National City may also verify the ongoing function of storm water management features that are not treatment or flow control facilities, such as permeable pavements and limitations on impervious area.

Operation and maintenance of storm water facilities is a six-stage process:

1. Determine **who will own** the facility and be responsible for the maintenance of treatment. Identify the means by which ongoing maintenance will be assured (for example, a maintenance agreement that runs with the land).

2. Identify typical maintenance requirements, and allow for these requirements in your project planning and preliminary design.

3. Prepare a **maintenance plan** for the site incorporating detailed requirements for **each treatment and flow-control facility**.

4. **Maintain** the facilities from the time they are constructed until ownership and maintenance responsibility is formally transferred.

5. **Formally transfer** operation and maintenance **responsibility** to the site owner or occupant. A warranty, secured by a bond, or other financial instrument, may be required to secure against lack of performance due to flaws in design or construction.

6. Maintain the facilities in perpetuity and comply with self-inspection, reporting, and verification requirements.

See the schedule for these stages in Table 5-1.

Stage 1: Ownership and Responsibility

You must specify a means to **ensure maintenance** of treatment and flow-control facilities **in perpetuity.**

Depending on the intended use of your site, this will require one or more of the following:

- Project proponent agreement to maintain storm water BMPs: The City may enter into a contract with the project proponent obliging the project proponent to maintain, repair, and replace the storm water BMP as necessary into perpetuity. Security may be required.

- Assessment districts: The City may approve an Assessment District or other funding mechanism proposed by the project proponent to provide funds for storm water BMP maintenance, repair, and replacement on an ongoing basis. Any agreement with such a District shall be subject to the Public Entity Maintenance Provisions above.

- Lease provisions: In those cases where the City holds title to the land in question, and the land is being leased to another party for private or public use, the City may assure storm water BMP maintenance, repair, and replacement through conditions in the lease.

- Public entity maintenance: The City may approve a public or acceptable quasi-public entity (e.g., the County Flood Control District, or annex to an existing assessment district, an existing utility district, a state or federal resource agency, or a conservation conservancy) to assume responsibility for maintenance, repair and replacement of the permanent treatment BMP. Unless acceptable to the City, public entity maintenance agreements shall ensure estimated costs are front-funded or reliably guaranteed, (e.g., through a trust fund, assessment district fees, bond, letter of credit or similar means). In addition, the City may seek protection from liability by appropriate releases and indemnities. The City shall have the authority to approve storm water BMPs proposed for transfer to any other public entity within its jurisdiction before installation. The City shall be involved in the negotiation of maintenance requirements with any other public entities accepting maintenance responsibilities within their respective jurisdictions; and in negotiations with the resource agencies responsible for issuing permits for the construction and/or maintenance of the facilities. The City must be identified as a third party beneficiary empowered to enforce any such maintenance agreement within their respective jurisdictions.

- Conditional use permits: For discretionary projects only, the City may assure maintenance of storm water BMPs through the inclusion of maintenance conditions in the conditional use permit. Security or performance bonds may be required.

The City may accept alternative maintenance mechanisms if such mechanisms are as protective as those listed above.

Typically, for discretionary projects, National City-approved methods of storm water BMP maintenance shall be incorporated into the project's permit, and shall be consistent with permits issued by resource agencies before approval of discretionary permits. For projects requiring only ministerial permits, the National City approved method of storm water BMP maintenance shall be incorporated into the permit conditions before the issuance of any ministerial permits. In all instances, the project proponent shall provide proof of execution of National City approved method of maintenance repair and replacement before the issuance of construction approvals.

Public projects that are not required to obtain National City permits shall be required and be responsible for ensuring that National City approved methods of storm water BMP maintenance, repair and replacement is executed prior to the commencement of construction. For all properties, the verification mechanism will include the project proponent's signed statement, as part of the project application, accepting and guaranteeing responsibility for all structural BMP maintenance, repair and replacement, until a National City approved entity agrees to assume responsibility for structural BMP maintenance, repair and replacement.

Ownership and maintenance responsibility for treatment and flow-control facilities should be discussed at the **beginning of project planning**, typically at the pre-application meeting for planning and zoning review. Experience has shown provisions to finance and implement maintenance of treatment and flow-control facilities can be a major stumbling block to project approval, particularly for **small residential subdivisions**. (See “New Subdivisions” in Chapter 1.)

► PRIVATE OWNERSHIP AND MAINTENANCE

The City of National City requires—as a condition of project approval—that a maintenance agreement be executed.

These agreements could provide that the City of National City may collect a management and/or inspection fee established by a standard fee schedule, as applicable. In addition, as part of the maintenance mechanism selected above, National City shall require an executed access easement or agreement that is binding on the land throughout the life of the project, or until such time that the storm water BMP requiring access is replaced. The agreement provides that, if the property owner fails to maintain the storm water facility, the City may enter the property, restore the storm water facility to good working order, and obtain reimbursement, including administrative costs, from the property owner.

TABLE 5-1. Schedule for Planning BMP Operation and Maintenance

Stage	Description	Schedule
1	Determine facility ownership and maintenance responsibility	Discuss with planning staff at pre-application meeting
2	Identify typical maintenance requirements	In initial submittal, coordinate with planning & zoning application
3	Develop detailed operation and maintenance plan	Provided with Project Submittal, and updated as necessary if any information changes prior to Stage 5.
4	Interim operation and maintenance of facilities	During and following construction including warranty period
5	Formal transfer of operation & maintenance responsibility	On sale and transfer of property or permanent occupancy
6	Ongoing maintenance and compliance with inspection & reporting requirements	In perpetuity

► TRANSFER TO PUBLIC OWNERSHIP

The City of National City may sometimes choose to have a treatment and flow-control facility deeded to the public, in fee or as an easement, and maintain the facility as part of the municipal storm drain system. The City may recoup the costs of maintenance through a special tax, assessment district, or similar mechanism.

Locating an IMP in a public right-of-way or easement creates an additional design constraint—along with hydraulic grade, aesthetics, landscaping, and circulation. However, because sites typically drain to the street, it may be possible to locate a bioretention swale parallel with the edge of the parcel. The facility may complement, or substitute for, an underground storm drain system.

Even if the facility is to be transferred to the City of National City after construction is complete, it is still the responsibility of the builder to identify general operation and maintenance requirements, prepare a detailed operation and maintenance plan, and to maintain the facility until that responsibility is formally transferred.

Stage 2: General Maintenance Requirements

Include in your Project Submittal a general description of anticipated facility maintenance requirements. This will help ensure that:

- Ongoing costs of maintenance have been considered in your facility selection and design.

- Site and landscaping plans provide for access for inspections and by maintenance equipment.
- Landscaping plans incorporate irrigation requirements for facility plantings.
- Initial maintenance and replacement of facility plantings is incorporated into landscaping contracts and guarantees.

Fact sheets available on the Project Clean Water web page describe general maintenance requirements for the types of storm water facilities featured in the LID Design Guide (Chapter 4). You can use this information to specify general maintenance requirements in your Project Submittal.

Maintenance fact sheets for conventional storm water facilities are available in the California Stormwater BMP Handbooks.

Stage 3: Detailed Maintenance Plan

Prepare a detailed maintenance plan and submit it as required by the City of National City. A detailed maintenance plan must be included with the initial Project Submittal; however the maintenance plan may later be updated to incorporate solutions to any problems or changes that occurred during project construction.

Your detailed maintenance plan should be kept on-site for use by maintenance personnel and during site inspections. It is also recommended that a copy of your initial Project Submittal be kept onsite as a reference.

► YOUR DETAILED MAINTENANCE PLAN: STEP BY STEP

The following step-by-step guidance will help you prepare your detailed maintenance plan.

Preparation of the plan will require familiarity with your storm water facilities as they have been or will be constructed and a fair amount of "thinking through" plans for their operation and maintenance.

► STEP 1: DESIGNATE RESPONSIBLE INDIVIDUALS

To begin creating your detailed maintenance plan, designate and identify:

- The individual who will have direct responsibility for the maintenance of storm water controls. This individual should be the designated contact with City inspectors and should sign self-inspection reports and any correspondence with the City of National City regarding verification inspections.
- Employees or contractors who will report to the designated contact and are responsible for carrying out BMP operation and maintenance.

- The corporate officer authorized to negotiate and execute any contracts that might be necessary for future changes to operation and maintenance or to implement remedial measures if problems occur.

- Your designated respondent to problems, such as clogged drains or broken irrigation mains, that would require immediate response should they occur during off-hours.

Updated contact information must be provided to the City of National City immediately whenever a property is sold and whenever designated individuals or contractors change.

Draw or sketch an **organization chart** to show the relationships of authority and responsibility between the individuals responsible for maintenance. This need not be elaborate, particularly for smaller organizations.

Describe how **funding for BMP operation and maintenance** will be assured, including sources of funds, budget category for expenditures, process for establishing the annual maintenance budget, and process for obtaining authority should unexpected expenditures for major corrective maintenance be required.

Describe how your organization will accommodate initial **training** of staff or contractors regarding the purpose, mode of operation, and maintenance requirements for the storm water facilities on your site. Also, describe how your organization will ensure ongoing training as needed and in response to staff changes.

► STEP 2: SUMMARIZE DRAINAGE AND BMPS

Incorporate the following information from your Project Submittal into your maintenance plan:

- Figures delineating and designating pervious and impervious areas.

- Figures showing locations of storm water facilities on the site.

- Tables of pervious and impervious areas served by each facility.

Review the Project Submittal narrative, if any, that describes each facility and its tributary drainage area and update the text to incorporate any changes that may have occurred during planning and zoning review, building permit review, or construction. Incorporate the updated text into your maintenance plan.

► STEP 3: DOCUMENT FACILITIES "AS BUILT"

Include the following information from final construction drawings:

- Plans, elevations, and details of all facilities. Annotate if necessary with designations used in the initial Project Submittal.

- Design information or calculations submitted in the detailed design phase (i.e., not included in the initial Project Submittal.)

- Specifications of construction for facilities, including sand or soil, compaction, pipe materials and bedding.

In the maintenance plan, note field changes to design drawings, including changes to any of the following:

- Location and layouts of inflow piping, flow splitter boxes, and piping to off-site discharge
- Depths and layering of soil, sand, or gravel
- Placement of filter fabric or geotextiles
- Changes or substitutions in soil or other materials.
- Natural soils encountered (e.g., sand or clay lenses)

► STEP 4: PREPARE MAINTENANCE PLANS FOR EACH FACILITY

Prepare a maintenance plan, schedule, and inspection checklists (routine, annual, and after major storms) for each facility. Plans and schedules for two or more similar facilities on the same site may be combined.

Use the following resources to prepare your customized maintenance plan, schedule, and checklists.

- Specific information noted in Steps 2 and 3, above.
- Other input from the facility designer, City staff, or other sources.
- Operation and Maintenance Fact Sheets (available on the Project Clean Water website).

Note any particular characteristics or circumstances that could require attention in the future, and include any troubleshooting advice.

Also include manufacturer's data, operating manuals, and maintenance requirements for any:

- Pumps or other mechanical equipment.
- Proprietary devices used as BMPs.

Manufacturers' publications should be referenced in the text (including models and serial numbers where available). Copies of the manufacturers' publications should be included as an attachment in the back of your maintenance plan or as a separate document.

► STEP 5: COMPILE MAINTENANCE PLAN

The following general outline is provided as an example.

I. Inspection and Maintenance Log

II. Updates, Revisions and Errata

III. Introduction

- A. Narrative overview describing the site; drainage areas, routing, and discharge points; and treatment facilities.

IV. Responsibility for Maintenance

- A. General
  - (1) Name and contact information for responsible individual(s).
  - (2) Organization chart or charts showing organization of the maintenance function and location within the overall organization.
  - (3) Reference to Operation and Maintenance Agreement (if any). A copy of the agreement should be attached.
  - (4) Maintenance Funding
    - (1) Sources of funds for maintenance
    - (2) Budget category or line item
    - (3) Description of procedure and process for ensuring adequate funding for maintenance
- B. Staff Training Program
- C. Records
- D. Safety

V. Summary of Drainage Areas and Storm Water Facilities

- A. Drainage Areas
  - (1) Drawings showing pervious and impervious areas (copied or adapted from initial Project Submittal).
  - (2) Designation and description of each drainage area and how flow is routed to the corresponding facility.
- B. Treatment and Flow-Control Facilities
  - (1) Drawings showing location and type of each facility
  - (2) General description of each facility (Consider a table if more than two facilities)

(1) Area drained and routing of discharge.

(2) Facility type and size

VI. Facility Documentation

A. "As-built" drawings of each facility (design drawings in the draft Plan)

B. Manufacturer's data, manuals, and maintenance requirements for pumps, mechanical or electrical equipment, and proprietary facilities (include a "placeholder" in the draft plan for information not yet available).

C. Specific operation and maintenance concerns and troubleshooting

VII. Maintenance Schedule or Matrix

A. Maintenance Schedule for each facility with specific requirements for:

(1) Routine inspection and maintenance

(2) Annual inspection and maintenance

(3) Inspection and maintenance after major storms

B. Service Agreement Information

Assemble and make copies of your maintenance plan. One copy must be submitted to the City of National City, and at least one copy kept on-site. Here are some suggestions for formatting the maintenance plan:

- Format plans to 8½" x 11" to facilitate duplication, filing, and handling.
- Include the revision date in the footer on each page.
- Scan graphics and incorporate with text into a single electronic file. Keep the electronic file backed-up so that copies of the maintenance plan can be made if the hard copy is lost or damaged.

► STEP 6: UPDATES

Your maintenance plan will be **a living document**.

Operation and maintenance personnel may change; mechanical equipment may be replaced, and additional maintenance procedures may be needed. Throughout these changes, the maintenance plan must be kept up-to-date.

Updates may be transmitted to the City of National City at any time. However, at a minimum, updates to the maintenance plan must be reported with the annual submittal of the "BMP Operation and Maintenance Verification Form," or equivalent, to the City.

Stage 4: Interim Maintenance

Applicants will typically be required to warranty storm water facilities against lack of performance due to flaws in design or construction. The warranty may need to be secured by a bond or other financial instrument.

Stage 5: Transfer Responsibility

As part of the detailed maintenance plan, note the expected date when responsibility for operation and maintenance will be transferred. Notify the City of National City when this transfer of responsibility takes place.

Stage 6: Operation & Maintenance Verification

The City of National City implements an operation and maintenance verification program, including periodic site inspections.

Contact City staff to determine the frequency of inspections, whether self-inspections are allowed, and applicable fees, if any.

References and Resources

- *Urban Runoff Quality Management* (WEF/ASCE, 1998). pp 186-189.
- *Stormwater Management Manual* (Portland, 2004). Chapter 3.
- *California Storm Water Best Management Practice Handbooks* (CASQA, 2003).
- *Best Management Practices Guide* (Public Telecommunications Center for Hampton Roads, 2002).
- Operation, Maintenance, and Management of Stormwater Management Systems (Watershed Management Institute, 1997)

Appendix A

National Pollutant Discharge Elimination System (NPDES) Project Applicability Form

City of National City

1243 National City Blvd.
National City, CA 91950
(619) 336-4580

National Pollutant Discharge Elimination System (NPDES) Project Applicability Form

No project will be accepted by the City without this form completed in its entirety

Project Name: ______________________________ Project Area: ____________ acres/sq ft

Project Address: ____

APN: ___________________ Proposed Impervious Area:_____________________ acres/sq ft

Description of Project: ____

Description of Location: ____

Section 1 – Permanent Storm Water BMP Requirements:

Part A: Determine Subjectivity to SUSMP Requirements

Is the project new development? ☐ *Yes* ☐ *No*

Is the project redevelopment that adds/replaces/creates 5,000 ft² of impervious surface[1]*?* ☐ *Yes* ☐ *No*

If both of the above answers are "no", go to Part B. If either of the above answers is "yes," answer the questions below (check all that apply).

Is the project…

1. Residential development resulting in the disturbance of one acre or more of land or comprised of 10 or more attached or detached dwelling units?	☐ *Yes*	☐ *No*
2. Commercial development resulting in the disturbance of one acre or more of land?	☐ *Yes*	☐ *No*
3. Industrial development resulting in the disturbance of one acre or more of land?	☐ *Yes*	☐ *No*
4. Automotive repair shop?	☐ *Yes*	☐ *No*
5. Restaurant greater than 5,000 square feet?	☐ *Yes*	☐ *No*
6. Steep (slope of 25% or more) hillside development that will create greater than 5,000 square feet of impervious surface?	☐ *Yes*	☐ *No*
7. Located such that it is within or directly adjacent to (within 200 feet) or directly discharges to an Environmentally Sensitive Area (ESA) <u>and</u> creates at least 2,500 square feet of impervious area or increases impervious area to 10% or more of its naturally occurring condition?	☐ *Yes*	☐ *No*
8. Parking lot greater than or equal to 5,000 square feet of impervious surface OR with at least 15 parking spaces and potentially exposed to urban runoff?	☐ *Yes*	☐ *No*
9. Streets, roads, highways, and freeways which would create a new paved surface that is 5,000 square feet or greater?	☐ *Yes*	☐ *No*
10. Retail gasoline outlets 5,000 square feet or more or with a project Average Daily Traffic (ADT of 100 or more vehicles per day	☐ *Yes*	☐ *No*
11. All other pollutant generating development projects that result in the disturbance of one acre or more of land.[2]	☐ *Yes*	☐ *No*

1 See the City's SUSMP Manual for more detail on the definition of "significant redevelopment."

2 Generally all projects which include impervious surfaces and/or introduce landscaping that requires routine use of fertilizers and pesticides are considered pollutant generating above background levels.

<u>Limited exclusion</u>: trenching and resurfacing work associated with utility projects are not considered Priority Development Projects. Linear pathway projects that are for infrequent vehicle use, such as emergency or maintenance access, or for pedestrian or bicycle use, are not considered pollutant generating above background levels if they are built with pervious surfaces or if they sheet flow to surrounding pervious surfaces. Parking lots, buildings and other structures associated with utility projects are Priority Development Projects if one or more of the criteria in Part A is met.

If any of the answers to Part A is "Yes", your project is a "Priority Development Project" and must meet the requirements of the City's Standard Urban Storm Water Mitigation Plan (SUSMP) Manual.

Is this a <u>Priority Development Project</u> that requires a SUSMP submittal? ☐ **Yes** ☐ **No**

If the answer is "Yes," see also the flow chart at the end of this checklist to determine applicability of Hydromodification Management Plan (HMP) requirements. HMP applicability must be discussed in the SUSMP report and all requirements must be met as part of the SUSMP Report approval process.

If all answers to Part A are "No", continue to PART B.

If any of the answers to Part A is "Yes", skip PART B and go to Section 2.

<u>Part B</u>: Determine Non-SUSMP Standard Permanent Storm Water BMP Requirements

Does the project require any of the following permits or approvals? ☐ *Yes* ☐ *No*

- *Discretionary: Conditional use permit (including modification or extension); Coastal development permit; Parcel map (and modifications); Reclamation plan; Planned development permits; Planned unit development permits; Planning commission approval of plans; Site plan review; Tentative map (and amendments to conditions of approval or time extension); Tentative parcel map; or Variance <u>OR</u>*
- *Ministerial: Administrative clearing permit; Lot line adjustment; Final map modification; Grading plan (including modification or renewal); Improvement plan (including modification); Landscape plan; Building permit; Construction right-of-way permit; Encroachment permit; Excavation permit; On-site wastewater system permit; Underground tank permit; or Well permit*

Will the project include exterior construction beyond signs, façade work, or other incidental construction to an existing structure? ☐ *Yes* ☐ *No*

If all answers to Part A are "No" and any answer to Part B is "Yes", your project is subject to the City's Standard Permanent Storm Water Best Management Practice (BMP) requirements as listed in Municipal Code Chapter 14.22.

Is this project subject to the Standard Permanent Storm Water BMP requirements? ☐ **Yes** ☐ **No**

If every question in both Parts A and B is answered "No", your project is exempt from non-SUSMP Standard Permanent Storm Water requirements.

☐ **This project is for interior improvements only and is <u>not</u> subject to non-SUSMP Standard Permanent Storm Water BMP requirements.**

Verified by: ____________________________ Division: ___________________ Date: ___________

Section 2 – Construction Requirements:

<u>General Construction Permit</u>
If your project disturbs at least one acre of land, you are subject to the State General Construction Permit. A Notice of Intent (NOI), Storm Water Pollution Prevention Plan (SWPPP), and other documents must be prepared for your project and filed electronically with the State Water Resources Control Board (SWRCB).

Is this project subject to the General Construction Permit? ☐ **Yes** ☐ **No**

If your project disturbs less than one acre of land, you are subject to the City's minimum construction BMPs, included in the City's BMP Manual.

<u>Construction Threat to Water Quality Prioritization</u>
See the attached flow chart for guidance in determining the construction prioritization.

This project is prioritized as a ☐ HIGH ☐ MEDIUM ☐ LOW threat to water quality.

Section 3 – Operating Requirements:

After your project is complete, certain water quality protection requirements may apply to the facility. The facility owner and operator should be made aware of these requirements.

All municipal, industrial, commercial, and residential sites in the City of National City are required to implement storm water BMPs to reduce the amount of pollution discharged to the Maximum Extent Practicable (MEP). See Appendix C of the City's Jurisdictional Urban Runoff Management Plan (JURMP) for further details.

Some industrial facilities are also subject to the State General Industrial Permit for Storm Water Discharges (Industrial Permit). To find out if your project may be required to obtain coverage under the Industrial Permit after it begins operations, visit the State Water Resources Control Board web site at http://www.swrcb.ca.gov/water_issues/programs/stormwater/industrial.shtml.

Section 4 – Certification:

Name and Title of person completing form: ______________________________ ____________________

Telephone number: (______) ______–________ Fax number: (______) ______–________

E-mail Address: ____ (optional)

I understand that as a condition of my permit, I am required to prevent construction-generated and related pollutants from discharging from the project site. All construction projects within the City of National City are required to implement Best Management Practices (BMPs). I have received a copy of the Construction Site BMP handout.

Signature of responsible party: ______________________________________ Date: ________________

For City of National City Use Only

Engineering Division

The information provided is consistent with the proposed plans ☐ **Yes** ☐ **No**

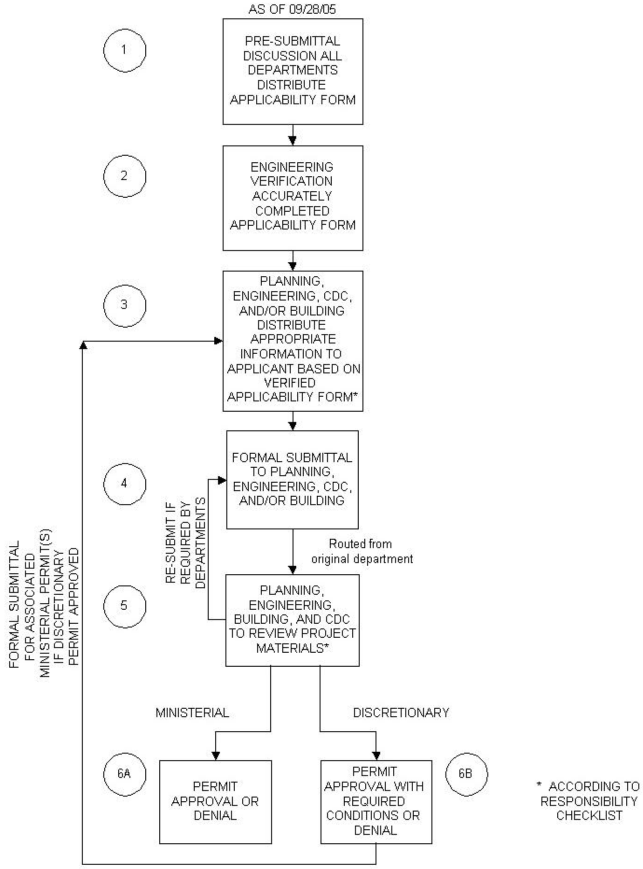
Information/documentation disseminated for SUSMP
☐ Standard Permanent Storm Water BMPs ☐ Non-SUSMP Standard Permanent Storm Water BMPs
☐ General Construction Permit ☐ Erosion & Sediment Control ☐ General Industrial Permit
☐ N/A (No required documentation) ☐ Other ____

Signature: ____ *Date:* _____________________

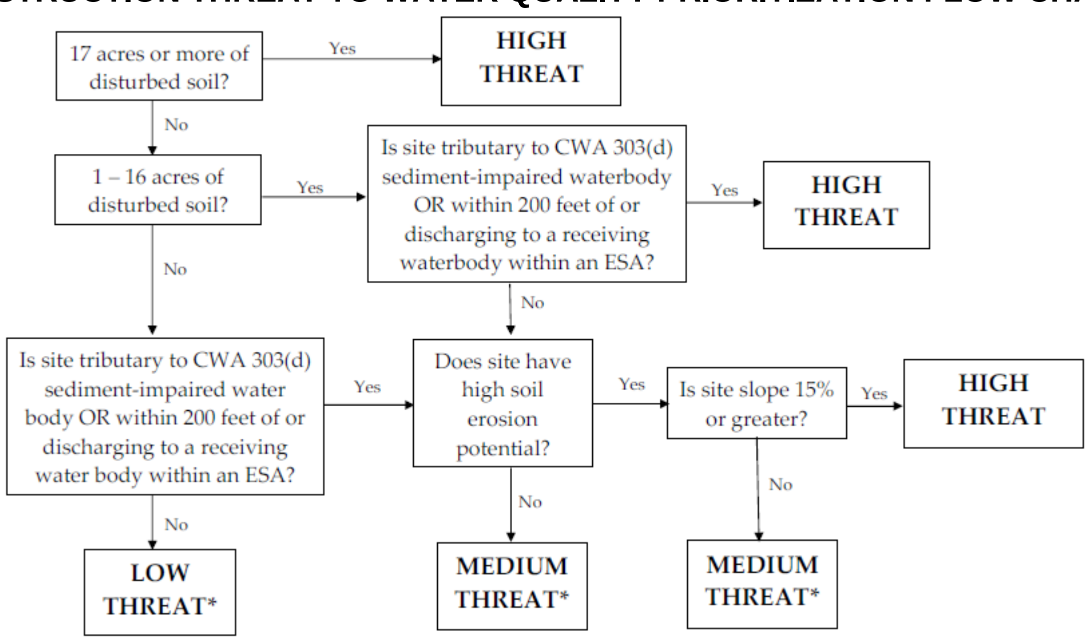
☐ **Planning Division** **OR** ☐ **Community Development Commission** *Initial:* _____________

☐ **Building Division** *Initial:* _____________ ☐ BMP information distributed

SUSMP REVIEW FLOW CHART



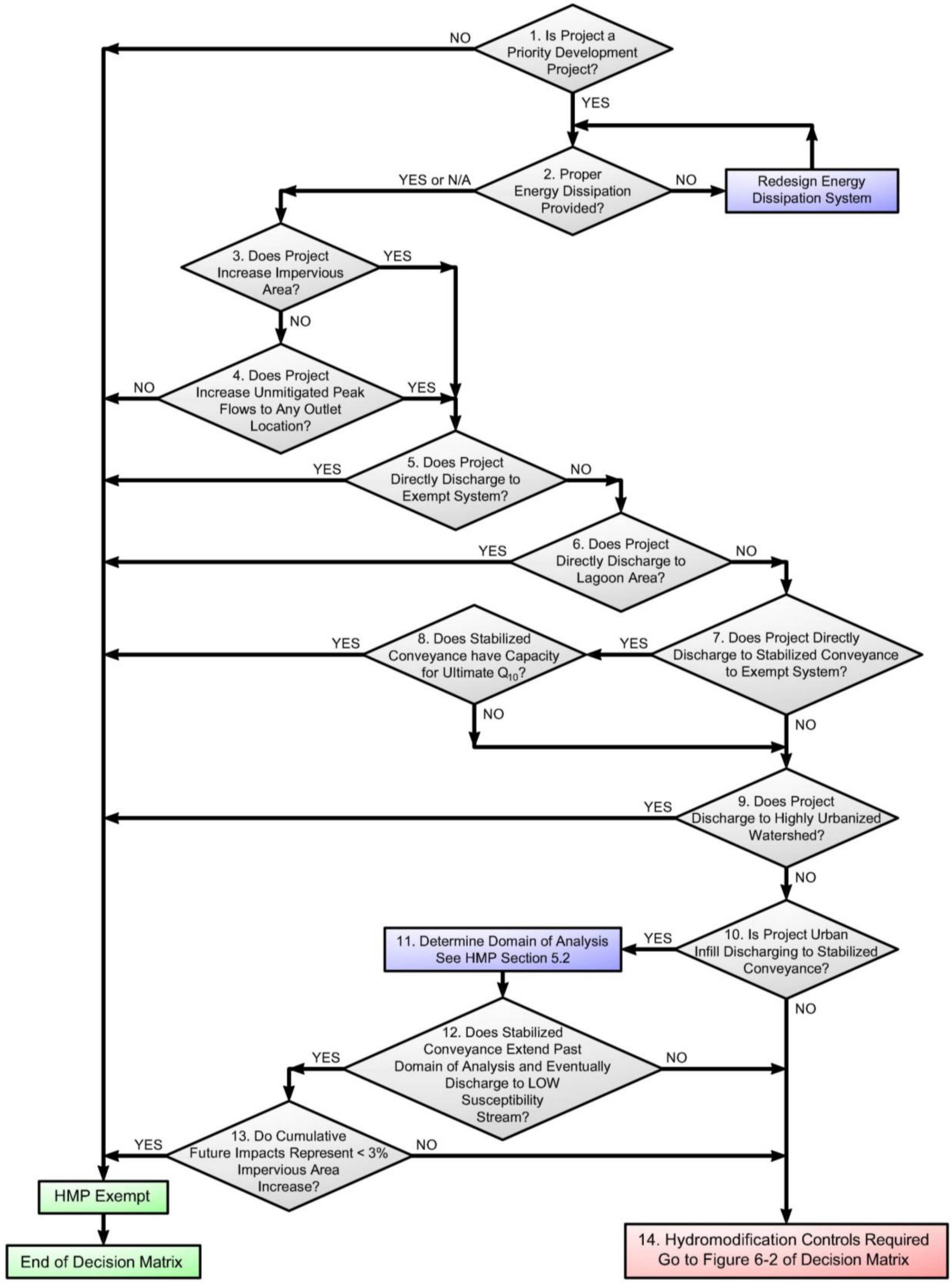
CONSTRUCTION THREAT TO WATER QUALITY PRIORITIZATION FLOW CHART



*Sites with a low or medium TTWQ can be given a higher threat prioritization based on additional factors, such as project type, non-storm water discharge potential, or if there is a history of non-compliance with storm water regulations at the site.

CWA 303(d) waterbodies: Seventh Street Channel, La Paleta Creek, San Diego Bay, and Sweetwater River
ESA waterbodies: Paradise Marsh, Paradise Creek, and Sweetwater Marsh National Wildlife Refuge

HYDROMODIFICATION MANAGEMENT PLAN (HMP) APPLICABILITY FLOW CHART



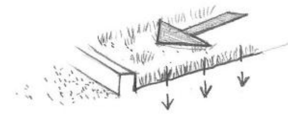
See the Regional Final Hydromodification Management Plan (HMP) for specific requirements, definitions, and details. The Final HMP is available in Appendix E of the City's SUSMP Manual or online at http://www.projectcleanwater.org/html/wg_susmp.html

Appendix B

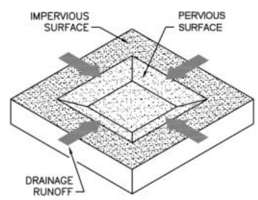
Low Impact Development (LID) Integrated Management Practice (IMP) Design Sheets

Self-Treating and Self-Retaining Areas

► **CRITERIA**



Rainfall on self-treating areas infiltrates or—during intense storms— drains directly off-site or to the storm drain system.



Self-retaining areas are designed to retain the first one inch of rainfall without producing any runoff. During intense storms, runoff may drain off-site, to the storm drain system, or to IMPs.

LID design seeks to manage runoff from roofs and paving so effects on water quality and hydrology are minimized. Runoff from landscaping, however, does not need to be managed the same way.

Runoff from landscaping can be managed by creating self-treating and self-retaining areas.

Best Uses

- Heavily landscaped sites

Advantages

- No maintenance verification requirement
- Complements site landscaping

Limitations

- Requires substantial square footage
- Grading requirements must be coordinated with landscape design

Self-treating areas are natural, landscaped, or turf areas that drain directly off site or to the storm drain system. Examples include upslope undeveloped areas that are ditched and drained around a development and grassed slopes that drain offsite to a street or storm drain. Self-treating areas may not drain on to adjacent paved areas.

Where a landscaped area is upslope from or surrounded by paved areas, a **self-retaining area** (also called a zero-discharge area) may be created. Self-retaining areas are designed to retain the first one inch of rainfall without producing any runoff. The technique works best on flat, heavily landscaped sites. It may be used on mild slopes if there is a reasonable expectation that the first inch of rainfall would produce no runoff.

To create self-retaining turf and landscape areas in flat areas or on terraced slopes, berm the area or depress the grade into a concave cross-section so that these areas will retain the first inch of rainfall. Inlets of area drains, if any, should be set 3 inches above the low point to allow ponding.

Areas draining to self-retaining areas. Drainage from roofs and paving can be directed to self-retaining areas and allowed to infiltrate into the soil. The maximum allowable ratio is 2 parts impervious: 1 part pervious.

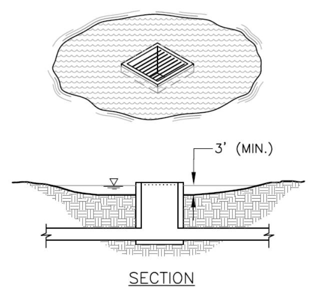
The self-retaining area must be bermed or depressed to retain an inch of rainfall including the flow from the tributary impervious area.

► **DETAILS**

Drainage from self-treating areas must flow to off-site streets or storm drains without flowing on to paved areas.

Pavement within a self-treating area cannot exceed 5% of the total area.

In self-retaining areas, overflows and area drain inlets should be set high enough to ensure ponding over the entire surface of the self-retaining area.



Set overflows and area drain inlets high enough to ensure ponding (3" deep) over the surface of the self-retaining area.

Self–retaining areas should be designed to promote even distribution of ponded runoff over the area.

Leave enough reveal (from pavement down to landscaped surface) to accommodate buildup of turf or mulch.

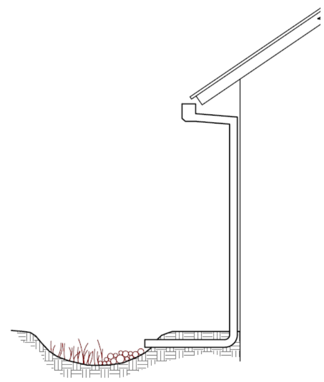
► **APPLICATIONS**

Lawn or landscaped areas adjacent to streets can be considered self-treating areas.

Self-retaining areas can be created by depressing lawn and landscape below surrounding sidewalks and plazas.

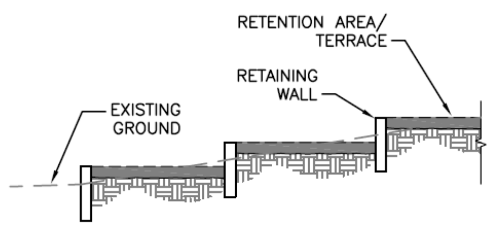
Runoff from walkways or driveways in parks and park-like areas can sheet-flow to self-retaining areas.

Roof leaders can be connected to self-retaining areas by piping beneath plazas and walkways. If necessary, a "bubble-up" can be used.



Connecting a roof leader to a self-retaining area. The head from the eave height makes it possible to route roof drainage some distance away from the building.

Self-retaining areas can be created by terracing mild slopes. The elevation difference promotes subsurface drainage.



Mild slopes can be terraced to create self-retaining areas.

► DESIGN CHECKLIST FOR SELF-TREATING AREAS

- ❒ The self-treating area is at least 95% lawn or landscaping (not more than 5% impervious).
- ❒ Re-graded or re-landscaped areas have amended soils, vegetation, and irrigation as may be required to maintain soil stability and permeability.
- ❒ Runoff from the self-treating area does not enter an IMP or another drainage management area, but goes directly to the storm drain system.

► DESIGN CHECKLIST FOR SELF-RETAINING AREAS

- ❒ Area is bermed all the way around or graded concave.

- ❐ Slopes do not exceed 4%.
- ❐ Entire area is lawn, landscaping, or pervious pavement (see criteria in Chapter 4).
- ❐ Area has amended soils, vegetation, and irrigation as may be required to maintain soil stability and permeability.
- ❐ Any area drain inlets are at least 3 inches above surrounding grade.

► DESIGN CHECKLIST FOR AREAS DRAINING TO SELF-RETAINING AREAS

- ❐ Ratio of tributary impervious area to self-retaining area is not greater than 2:1.
- ❐ Roof leaders collect runoff and route it to the self-retaining area.
- ❐ Paved areas are sloped so drainage is routed to the self-retaining area.
- ❐ Inlets are designed to protect against erosion and distribute runoff across the area.

Pervious Pavements

► CRITERIA

Impervious roadways, driveways, and parking lots account for much of the hydrologic impact of land development. In contrast, pervious pavements allow rainfall to collect in a gravel or sand base course and infiltrate into native soil.

Pervious pavements are designed to transmit rainfall through the surface to storage in a base course. For example, a 4-inch-deep base course provides approximately 1.6 inches of storage. Runoff stored in the base course infiltrates to native soils over time. Except in the case of solid pavers, the surface course provides additional storage.

Areas with the following pervious pavements may be regarded as "self-treating" and require no additional treatment or flow control if they drain off-site (not to an IMP).

- Pervious concrete
- Porous asphalt
- Crushed aggregate (gravel)
- Open pavers with grass or plantings
- Open pavers with gravel
- Artificial turf

Areas with these pervious pavements can also be **self-retaining areas** and may receive runoff from impervious areas if they are bermed or depressed to retain the first one inch of rainfall, including runoff from the tributary impervious area.

Solid unit pavers—such as bricks, stone blocks, or precast concrete shapes—are considered to reduce runoff compared to impervious pavement, when the unit pavers are set in sand or gravel with d" gaps between the pavers. Joints must be filled with an open-graded aggregate free of fines.

Best Uses

- Areas with permeable native soils
- Low-traffic areas
- Where aesthetic quality can justify higher cost

Advantages

- No maintenance verification requirement
- Variety of surface treatments can complement landscape design

Limitations

- Initial cost
- Placement requires specially trained crews
- Geotechnical concerns, especially in clay soils
- Concerns about pavement strength and surface integrity
- Some municipalities do not allow in public right of way

When draining pervious pavements to an IMP, use the runoff factors in Table 4-2.

► DETAILS

Permeable pavements can be used in clay soils; however, special design considerations, including an increased depth of base course, typically apply and will increase the cost of this option. Geotechnical fabric between the base course and underlying clay soil is recommended.

Pavement strength and durability typically determines the required depth of base course. If underdrains are used, the outlet elevation must be a minimum of 3 inches above the bottom elevation of the base course.

Pervious concrete and porous asphalt must be installed by crews with special training and tools. Industry associations maintain lists of qualified contractors.

Parking lots with crushed aggregate or unit pavers may require signs or bollards to organize parking.

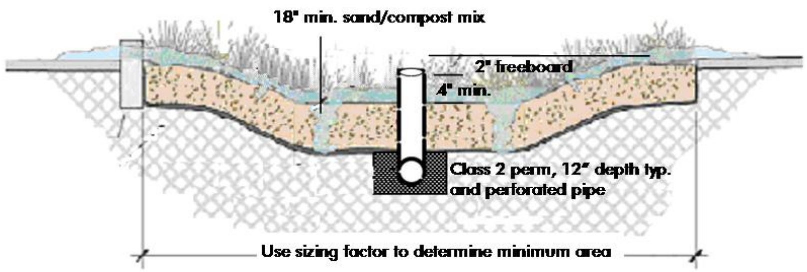
► DESIGN CHECKLIST FOR PERVIOUS PAVEMENTS

- ❒ No erodible areas drain on to pavement.
- ❒ Subgrade is uniform. Compaction is minimal.
- ❒ Reservoir base course is of open-graded crushed stone. Base depth is adequate to retain rainfall and support design loads.
- ❒ If a subdrain is provided, outlet elevation is a minimum of 3 inches above bottom of base course.
- ❒ Subgrade is uniform and slopes are not so steep that subgrade is prone to erosion.
- ❒ Rigid edge is provided to retain granular pavements and unit pavers.
- ❒ Solid unit pavers are installed with open gaps filled with open-graded aggregate free of fines.
- ❒ Permeable pavements are installed by industry-certified professionals according to vendor's recommendations.
- ❒ Selection and location of pavements incorporates Americans with Disabilities Act requirements, site aesthetics, and uses.

Resources

- Southern California Concrete Producers www.concreteresources.net.
- California Asphalt Pavement Association http://www.californiapavements.org/stormwater.html
- Interlocking Concrete Pavement Institute http://www.icpi.org/
- *Start at the Source Design Manual for Water Quality Protection,* pp. 47-53. www.basmaa.org
- *Porous Pavements,* by Bruce K. Ferguson. 2005. ISBN 0-8493-2670-2.

Bioretention Facilities



Bioretention facility configured for treatment-only requirements. Bioretention facilities can rectangular, linear, or nearly any shape.

Bioretention detains runoff in a surface reservoir, filters it through plant roots and a biologically active soil mix, and then infiltrates it into the ground. Where native soils are less permeable, an underdrain conveys treated runoff to storm drain or surface drainage.

Bioretention facilities can be configured in nearly any shape. When configured as linear **swales**, they can convey high flows while percolating and treating lower flows.

Bioretention facilities can be configured as in-ground or above-ground planter boxes, with the bottom open to allow infiltration to native soils underneath. If infiltration cannot be allowed, use the sizing factors and criteria for the Flow-Through Planter.

Best Uses

- Commercial areas
- Residential subdivisions
- Industrial developments
- Roadways
- Parking lots
- Fit in setbacks, medians, and other landscaped areas

Advantages

- Can be any shape
- Low maintenance
- Can be landscaped

Limitations

- Require 4% of tributary impervious square footage
- Typically requires 3-4 feet of head
- Irrigation typically required

► **CRITERIA**

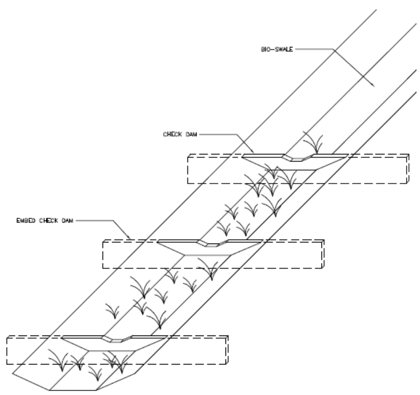
For development projects subject only to runoff treatment requirements, the following criteria apply:

Parameter	**Criterion**
Soil mix depth	18 inches minimum
Soil mix minimum percolation rate	5 inches per hour minimum sustained (10 inches per hour initial rate recommended)
Soil mix surface area	0.04 times tributary impervious area (or equivalent)

Parameter	Criterion
Surface reservoir depth	6 inches minimum; may be sloped to 4 inches where adjoining walkways.
Underdrain	Required in Group "C" and "D" soils. Perforated pipe embedded in gravel ("Class 2 permeable" recommended), connected to storm drain or other accepted discharge point.

► **DETAILS**

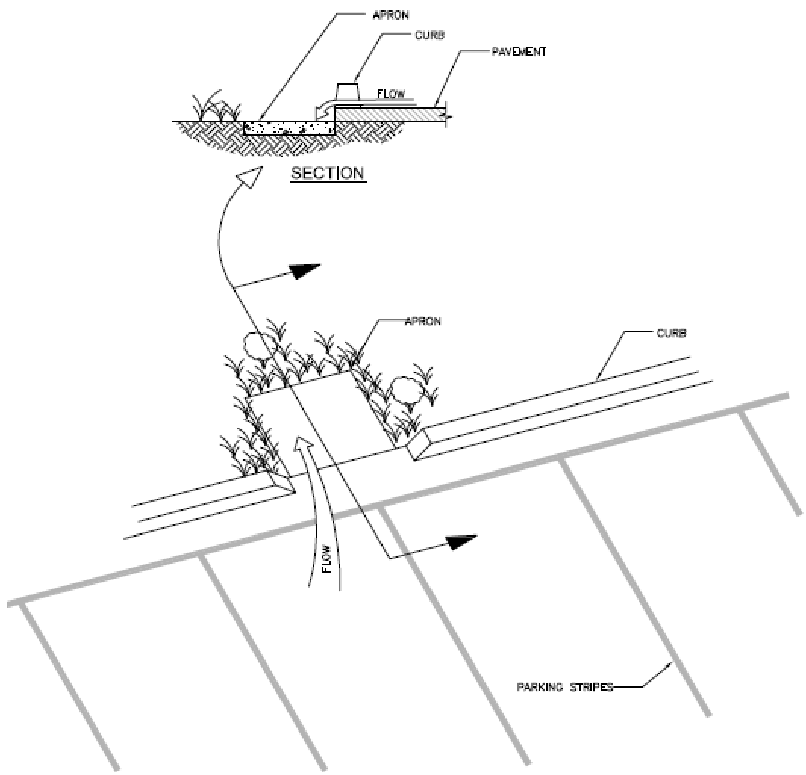
Plan. On the surface, a bioretention facility should be one level, shallow basin—or a series of basins. As runoff enters each basin, it should flood and fill throughout before runoff overflows to the outlet or to the next downstream basin. This will help prevent movement of surface mulch and soil mix.



Use check dams for linear bioretention facilities (swales) on a slope.

In a linear swale, check dams should be placed so that the lip of each dam is at least as high as the toe of the next upstream dam. A similar principle applies to bioretention facilities built as terraced roadway shoulders.

Inlets. Paved areas draining to the facility should be graded, and inlets should be placed, so that runoff remains as sheet flow or as dispersed as possible. Curb cuts should be wide (12" is recommended) to avoid clogging with leaves or debris. Allow for a minimum reveal of 4"-6" between the inlet and soil mix elevations to ensure turf or mulch buildup does not block the inlet. In addition, place an apron of stone or concrete, a foot square or larger, inside each inlet to prevent vegetation from growing up and blocking the inlet.



Recommended design details for bioretention facility inlets (see text).

Where runoff is collected in pipes or gutters and conveyed to the facility, protect the landscaping from high-velocity flows with energy-dissipating rocks. In larger installations, provide cobble-lined channels to better distribute flows throughout the facility.

Upturned pipe outlets can be used to dissipate energy when runoff is piped from roofs and upgradient paved areas.

Soil mix. The required soil mix is similar to a loamy sand. It must maintain a minimum percolation rate of 5" per hour throughout the life of the facility, and it must be suitable for maintaining plant life. Typically, on-site soils will not be suitable due to clay content.

Storage and drainage layer. "Class 2 permeable," Caltrans specification 68-1.025, is recommended. Open-graded crushed rock, washed, may be used, but requires 4"-6" washed pea gravel be substituted at the top of the crushed rock gravel layers. **Do not use filter fabric** to separate the soil mix from the gravel drainage layer or the gravel drainage layer from the native soil.

Underdrains. No underdrain is required where native soils beneath the facility are Hydrologic Soil Group A or B. For treatment-only facilities where native soils are Group C or D, a perforated pipe must be bedded in the gravel layer and must terminate at a storm drain or other approved discharge point.

Outlets. In treatment-only facilities, outlets must be set high enough to ensure the surface reservoir fills and the entire surface area of soil mix is flooded before the outlet elevation is reached. In swales, this can be achieved with appropriately placed check dams.

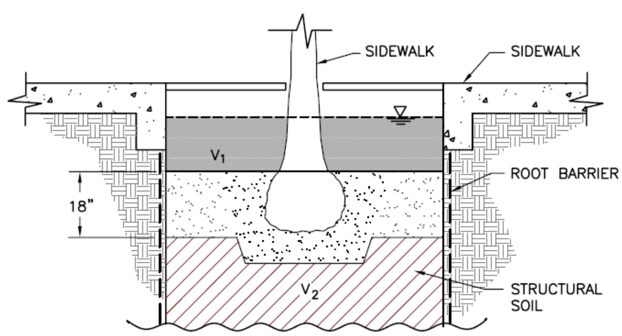
The outlet should be designed to exclude floating mulch and debris.

Vaults, utility boxes, and light standards. It is best to locate utilities outside the bioretention facility—in adjacent walkways or in a separate area set aside for this purpose. If utility structures are to be placed within the facility, the locations should be anticipated and adjustments made to ensure the minimum bioretention surface area and volumes are achieved. Leaving the final locations to each individual utility can produce a haphazard, unaesthetic appearance and make the bioretention facility more difficult to maintain.

Emergency overflow. The site grading plan should anticipate extreme events and potential clogging of the overflow and route emergency overflows safely.

Trees. Bioretention areas can accommodate small or large trees. There is no need to subtract the area taken up by roots from the effective area of the facility. Extensive tree roots maintain soil permeability and help retain runoff. Normal maintenance of a bioretention facility should not affect tree lifespan.

The bioretention facility can be integrated with a tree pit of the required depth and filled with structural soil. If a root barrier is used, it can be located to allow tree roots to spread throughout the bioretention facility while protecting adjacent pavement. Locations and planting elevations should be selected to avoid blocking the facility's inlets and outlets.



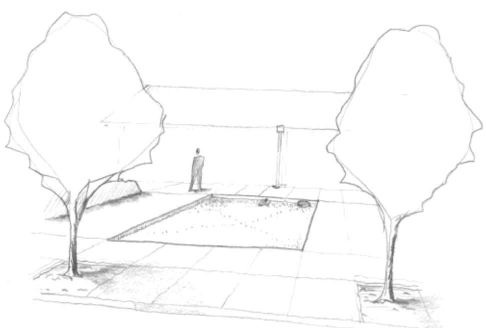
Bioretention facility configured as a tree well.
The root barrier is optional.

► APPLICATIONS

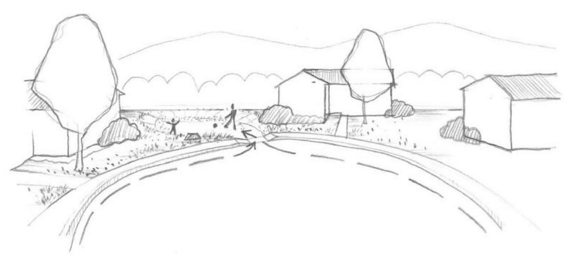
Multi-purpose landscaped areas. Bioretention facilities are easily adapted to serve multiple purposes. The loamy sand soil mix will support turf or a plant palette suitable to the location and a well-drained soil.

Example landscape treatments:

- Lawn with sloped transition to adjacent landscaping.
- Swale in setback area
- Swale in parking median
- Lawn with hardscaped edge treatment
- Decorative garden with formal or informal plantings
- Traffic island with low-maintenance landscaping
- Raised planter with seating
- Bioretention on a terraced slope



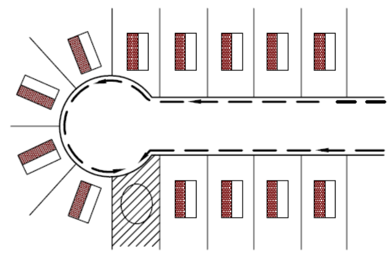
Bioretention facility configured as a recessed decorative lawn with hardscaped edge.



Bioretention facility configured and planted as a lawn/ play area.

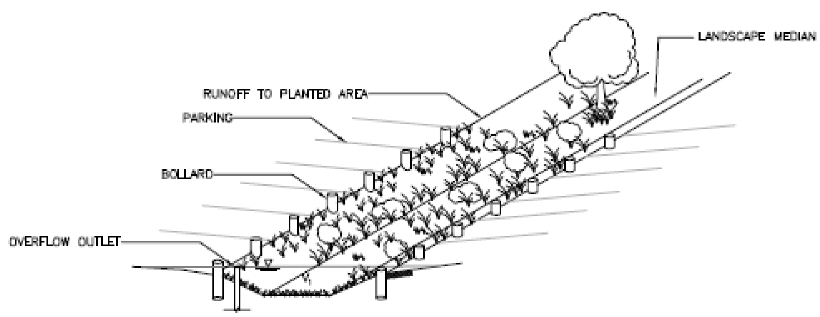
Residential subdivisions. Some subdivisions are designed to drain roofs and driveways to the streets (in the conventional manner) and then drain the streets to bioretention areas, with one bioretention area for each 1 to 6 lots, depending on subdivision layout and topography.

If allowed by the local jurisdiction, bioretention areas can be placed on a separate, dedicated parcel with joint ownership.



Bioretention facility receiving drainage from individual lots and the street in a residential subdivision.

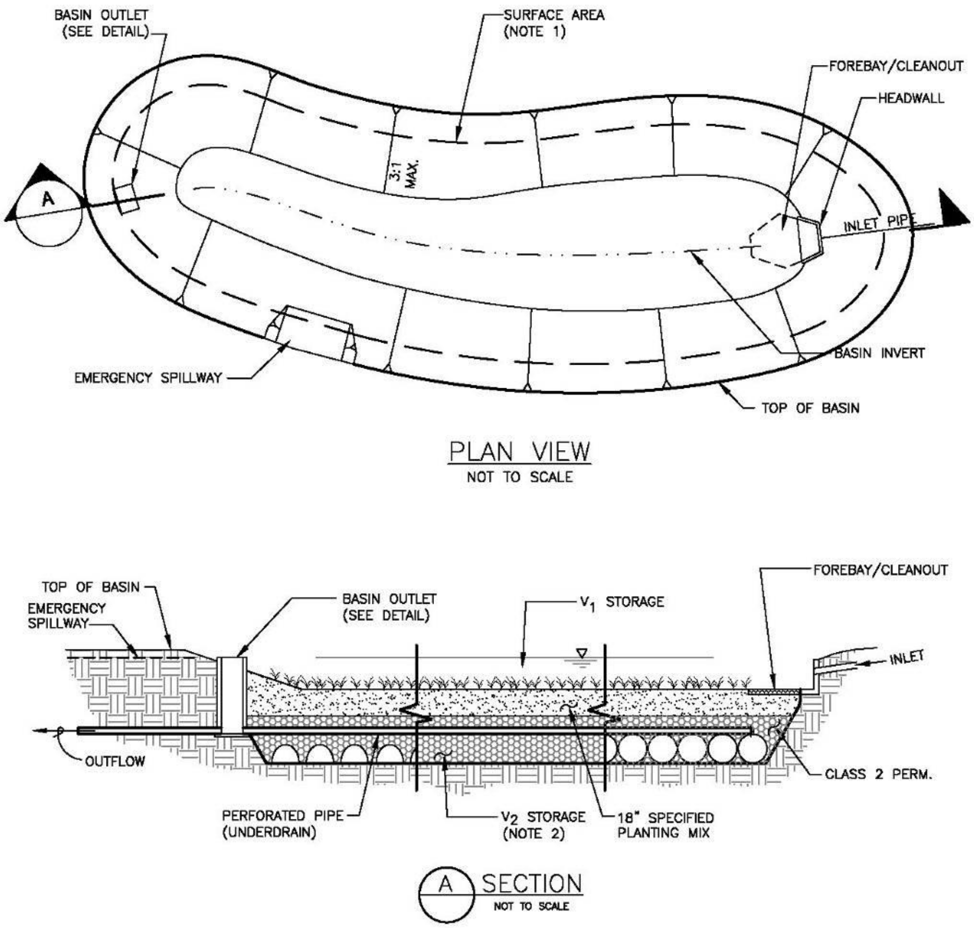
Sloped sites. Bioretention facilities must be constructed as a basin, or series of basins, with the circumference of each basin set level. It may be necessary to add curbs or low retaining walls.



Bioretention facility configured as a parking median.
Note use of bollards in place of curbs, eliminating the need for curb cuts.

Design Checklist for Bioretention

- ❒ Volume or depth of surface reservoir meets or exceeds minimum.
- ❒ 18" depth “loamy sand” soil mix with minimum long-term percolation rate of 5"/hour.
- ❒ Area of soil mix meets or exceeds minimum.
- ❒ Perforated pipe underdrain bedded in “Class 2 perm” with connection and sufficient head to storm drain or discharge point (except in “A” or “B” soils).
- ❒ No filter fabric.
- ❒ Underdrain has a clean-out port consisting of a vertical, rigid, non-perforated PVC pipe, with a minimum diameter of 6 inches and a watertight cap.
- ❒ Location and footprint of facility are shown on site plan and landscaping plan.
- ❒ Bioretention area is designed as a basin (level edges) or a series of basins, and grading plan is consistent with these elevations. If facility is designed as a swale, check dams are set so the lip of each dam is at least as high as the toe of the next upstream dam.
- ❒ Inlets are 12" wide, have 4"-6" reveal and an apron or other provision to prevent blockage when vegetation grows in, and energy dissipation as needed.
- ❒ Overflow connected to a downstream storm drain or approved discharge point.
- ❒ Emergency spillage will be safely conveyed overland.
- ❒ Plantings are suitable to the climate and a well-drained soil.
- ❒ Irrigation system with connection to water supply.
- ❒ Vaults, utility boxes, and light standards are located outside the minimum soil mix surface area.
- ❒ When excavating, avoid smearing of the soils on bottom and side slopes. Minimize compaction of native soils and “rip” soils if clayey and/or compacted. Protect the area from construction site runoff.

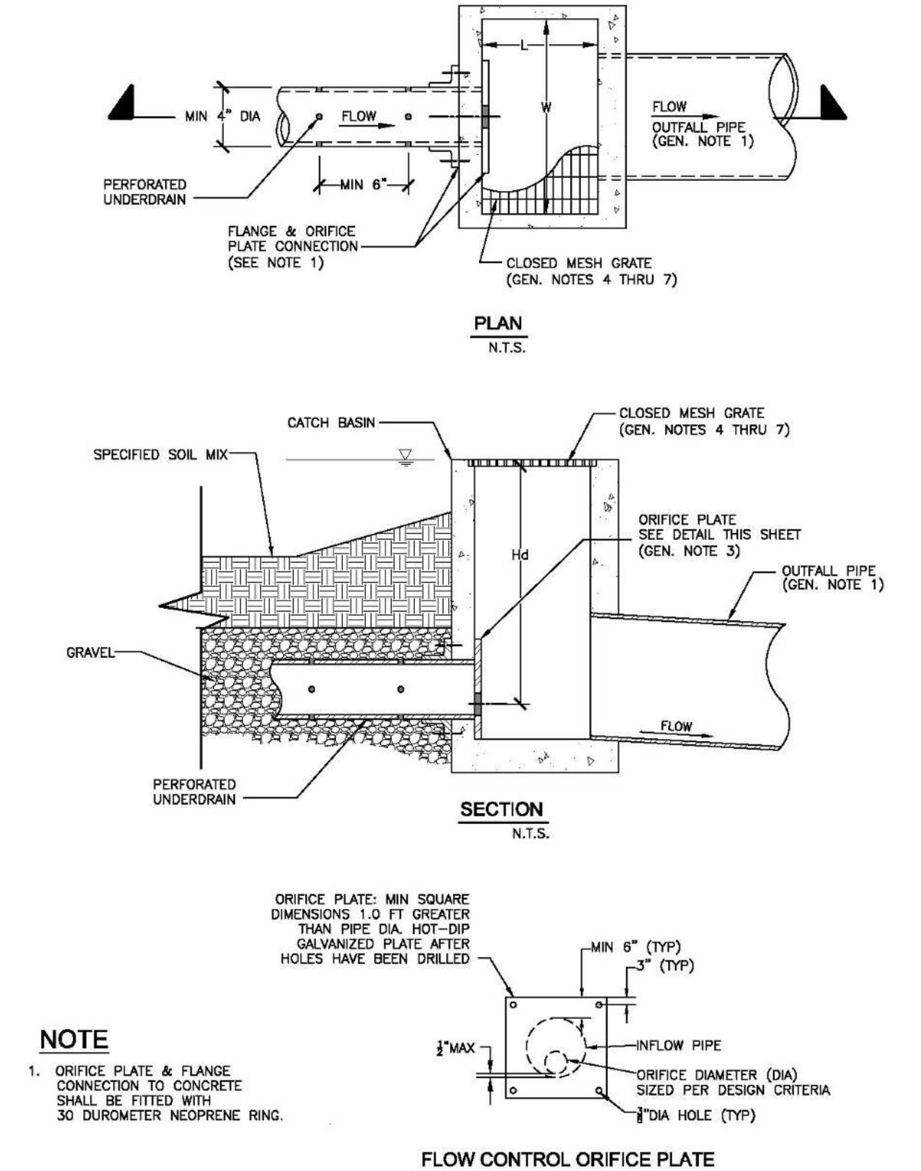


NOTE

1. SURFACE AREA LIMIT DETERMINED BY EXTENT OF SPECIFIED PLANTING MIX, WHICH IS GOVERNED BY THE OUTLET SPILL ELEVATION. FOR REQUIRED SURFACE AREA REFER TO THE FACTORS AND EQUATIONS IN THE STORMWATER C.3 GUIDEBOOK.

2. V_2 STORAGE ACCOMPLISHED WITH INFILTRATION ARCHES, PERFORATED PIPES, CLASS 2 PERM OR OTHER AT THE DESIGNERS DISCRETION.

Bioretention Facility



Bioretention Facility Outlet Detail - A

P:\Projects\San Diego County\133904 - SDCo Hydromod Management Plan\CAD\ES\CCCP_OutletDetails.dwg 6-09-08 07:18:00 PM estes

Flow-through Planter


Portland 2004 Stormwater Manual

Flow-through planters treat and detain runoff without allowing seepage into the underlying soil. They can be used next to buildings and on slopes where stability might be affected by adding soil moisture.

Flow-through planters typically receive runoff via downspouts leading from the roofs of adjacent buildings. However, they can also be set in-ground and receive sheet flow from adjacent paved areas.

Pollutants are removed as runoff passes through the soil layer and is collected in an underlying layer of gravel or drain rock. A perforated-pipe underdrain is typically connected to a storm drain or other discharge point. An overflow inlet conveys flows which exceed the capacity of the planter.

Best Uses

- Management of roof runoff
- Next to buildings
- Dense urban areas
- Where infiltration is not desired

Advantages

- Can be used next to structures
- Versatile
- Can be any shape
- Low maintenance

Limitations

- Can be used for flow-control only on sites with "C" and "D" soils
- Requires underdrain
- Requires 3-4 feet of head

► CRITERIA

Treatment only. For development projects subject only to runoff treatment requirements, the following criteria apply:

Parameter	Criterion
Soil mix depth	18 inches minimum
Soil mix minimum percolation rate	5 inches per hour minimum sustained (10 inches per hour initial rate recommended)

Parameter	Criterion
Soil mix surface area	0.04 times tributary impervious area (or equivalent)
Surface reservoir depth	6" minimum; may be sloped to 4" where adjoining walkways.
Underdrain	Typically used. Perforated pipe embedded in gravel ("Class 2 permeable" recommended), connected to storm drain or other accepted discharge point.

► **DETAILS**

Configuration. The planter must be level. To avoid standing water in the subsurface layer, set the perforated pipe underdrain and orifice as nearly flush with the planter bottom as possible.

Inlets. Protect plantings from high-velocity flows by adding rocks or other energy-dissipating structures at downspouts and other inlets.

Soil mix. The required soil mix is similar to a loamy sand. It must maintain a minimum percolation rate of 5" per hour throughout the life of the facility, and it must be suitable for maintaining plant life. Typically, on-site soils will not be suitable due to clay content.

Gravel storage and drainage layer. "Class 2 permeable," Caltrans specification 68-1.025, is recommended. Open-graded crushed rock, washed, may be used, but requires 4"-6" of washed pea gravel be substituted at the top of the crushed rock layer. **Do not use filter fabric** to separate the soil mix from the gravel drainage layer.

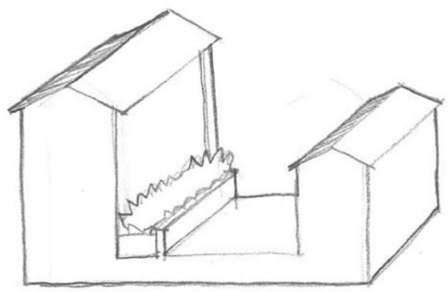
Emergency overflow. The planter design and installation should anticipate extreme events and potential clogging of the overflow and route emergency overflows safely.

► **APPLICATIONS**

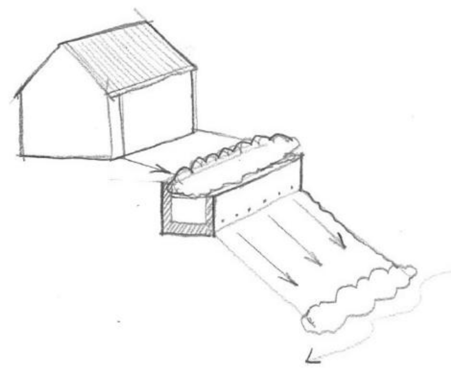
Adjacent to buildings. Flow-through planters may be located adjacent to buildings, where the planter vegetation can soften the visual effect of the building wall. A setback with a raised planter box may be appropriate even in some neo-traditional pedestrian-oriented urban streetscapes.

At plaza level. Flow-through planters have been successfully incorporated into podium-style developments, with the planters placed on the plaza level and receiving runoff from the tower roofs above. Runoff from the plaza level is typically managed separately by additional flow-through planters or bioretention facilities located at street level.

Steep slopes. Flow-through planters provide a means to detain and treat runoff on slopes that cannot accept infiltration from a bioretention facility. The planter can be built into the slope similar to a retaining wall. The design should consider the need to access the planter for periodic maintenance. Flows from the planter underdrain and overflow must be directed in accordance with local requirements. It is sometimes possible to disperse these flows to the downgradient hillside.



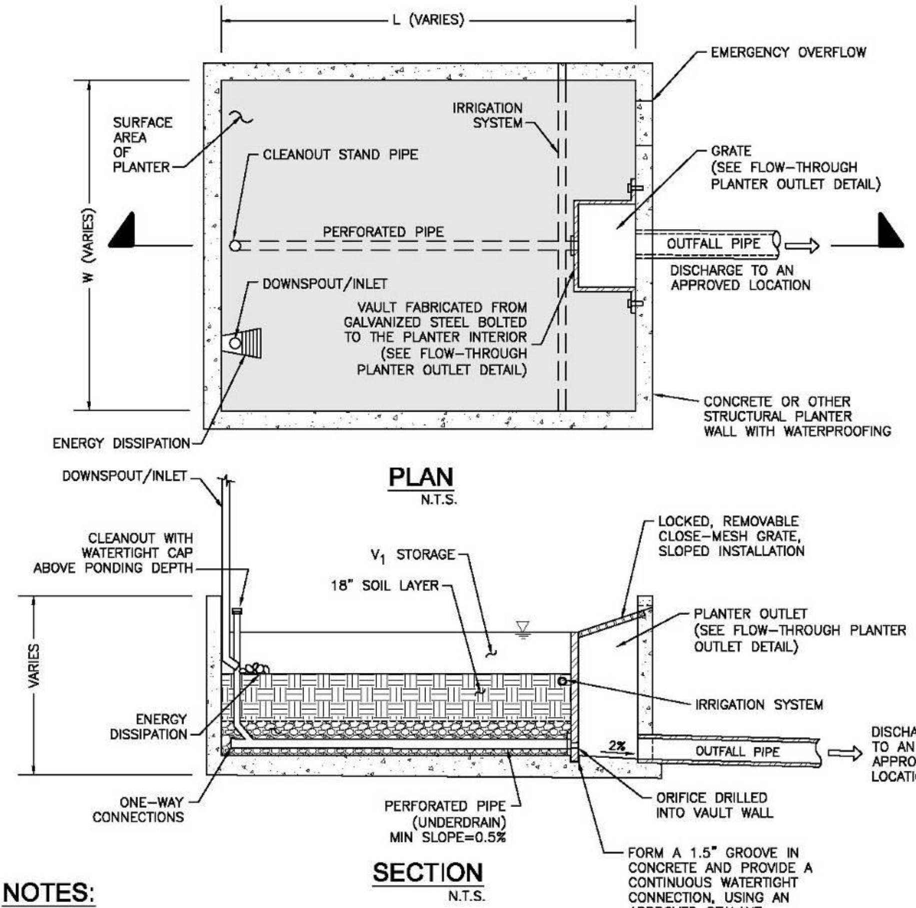
Flow-through planter on the plaza level of a podium-style development.



Flow-through planter built into a hillside. Flows from the underdrain and overflow must be directed in accordance with local requirements.

Design Checklist for Flow-through Planter

- ❒ Reservoir depth is 4-6" minimum.
- ❒ 18" depth “loamy sand” soil mix with minimum long-term infiltration rate of 5"/hour.
- ❒ Area of soil mix meets or exceeds minimum.
- ❒ “Class 2 perm” drainage layer.
- ❒ No filter fabric.
- ❒ Perforated pipe underdrain with outlet located flush or nearly flush with planter bottom. Connection with sufficient head to storm drain or discharge point.
- ❒ Underdrain has a clean-out port consisting of a vertical, rigid, non-perforated PVC pipe, with a minimum diameter of 6 inches and a watertight cap.
- ❒ Overflow connected to a downstream storm drain or approved discharge point.
- ❒ Location and footprint of facility are shown on site plan and landscaping plan.
- ❒ Planter is set level.
- ❒ Emergency spillage will be safely conveyed overland.
- ❒ Plantings are suitable to the climate and a well-drained soil.
- ❒ Irrigation system with connection to water supply.

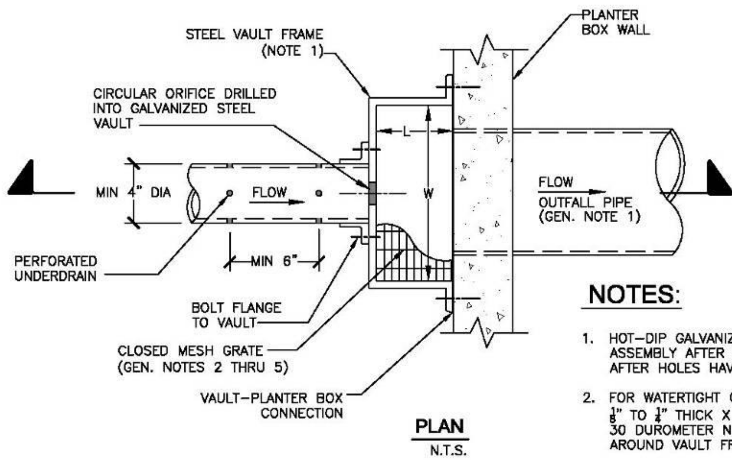


P:\Projects\San Diego County\133904 - SDCo Hydromod Management Plan\CAD\ES\CCCCP_FlowThruPlanter.dwg 6-09-08 08:58:44 PM estiles

NOTES:

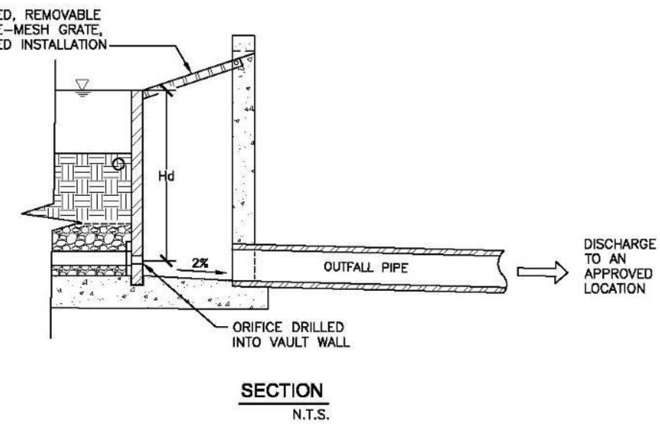
1. FLOW-THROUGH PLANTER SHALL BE SIZED TO MEET CCCWP CRITERIA FOR TREATMENT AND/OR FLOW CONTROL.
2. MINIMUM SURFACE AREA OF PLANTER IS 4% OF TRIBUTARY IMPERVIOUS AREA FOR TREATMENT ONLY DESIGN. FOR FLOW CONTROL AND TREATMENT, REFER TO CCCWP SIZING TOOL CRITERIA.
3. SHAPE OF PLANTER CAN VARY TO MEET PROJECT DESIGN REQUIREMENTS AND LOCATION.
4. CLASS 2 PERMEABLE MATERIAL
5. DOWNSPOUTS/INLET PIPES REQUIRE ENERGY DISSIPATION.
6. USE COUNTY APPROVED ADDITIVE MIXTURE FOR WATERPROOFING CONCRETE.
7. PLANTINGS: SEE CCCWP RECOMMENDED PLANT LIST AND GUIDELINES.
8. PLANTER DESIGN MAY REQUIRE STRUCTURAL ENGINEERING DESIGN.
9. AREA = W x L (ABOVE). EXCLUDES AREA OF VAULT

Flow-Through Planter Detail



NOTES:

1. HOT–DIP GALVANIZE ENTIRE FRAME ASSEMBLY AFTER FABRICATION AND AFTER HOLES HAVE BEEN DRILLED.
2. FOR WATERTIGHT CONNECTION, INSTALL $\frac{1}{8}$" TO $\frac{1}{4}$" THICK X 2" WIDE CONTINUOUS 30 DUROMETER NEOPRENE GASKET, ALL AROUND VAULT FRAME.



GENERAL OUTLET DETAIL NOTES:

1. OUTFALL PIPE SHALL BE SIZED TO CONVEY DESIGN STORM PER CCCWP DESIGN CRITERIA.
2. GRATE SHALL BE MOUNTED USING STAINLESS STEEL HARDWARE AND PROVIDED WITH HINGED AND LOCKABLE OR BOLTABLE ACCESS PANELS.
3. GRATE SHALL BE STAINLESS STEEL, ALUMINUM OR STEEL. STEEL GRATES SHALL BE HOT DIP GALVANIZED AND MAY BE HOT POWDER PAINTED AFTER GALVANIZING.
4. GRATE SHALL BE DESIGNED SUCH THAT THE DIAGONAL DIMENSION OF EACH OPENING IS SMALLER THAN THE DIAMETER OF THE OUTLET PIPE.
5. STRUCTURAL DESIGN OF GRATE SHALL BE BASED ON FULL HYDROSTATIC HEAD WITH ZERO HEAD DOWNSTREAM OF GRATE.

Flow-Through Planter Outlet Detail

Dry Wells and Infiltration Basins

The typical dry well is a prefabricated structure, such as an open-bottomed vault or box, placed in an excavation or boring. The vault may be empty, which provides maximum space efficiency, or may be filled in rock.

An infiltration basin has the same functional components—a volume to store runoff and sufficient area to infiltrate that volume into the native soil—but is open rather than covered.

► CRITERIA

Dry wells and infiltration basins must be designed with the minimum volume calculated by Equation 4-8 using a unit volume based on the County of San Diego's 85th Percentile Isopluvial Map.

Consult with the local jurisdiction engineer regarding the need to verify soil permeability and other site conditions are suitable for dry wells and infiltration basins. Some proposed criteria are on Page 5-12 of Caltrans' 2004 *BMP Retrofit Pilot Study Final Report* (CTSW-RT-01-050).

The infiltration rate and infiltrative area must be sufficient to drain a full facility within 96 hours.

► DETAILS

Dry wells should be sited to allow for the potential future need for removal and replacement.

In locations where native soils are coarser than a medium sand, the area directly beneath the facility should be over-excavated by two feet and backfilled with sand as a groundwater protection measure.

Best Uses

- Alternative to bioretention in areas with permeable soils

Advantages

- Compact footprint
- Can be installed in paved areas

Limitations

- Can be used only on sites with "A" and "B" soils
- Requires minimum of 10' from bottom of facility to seasonal high groundwater
- Not suitable for drainage from some industrial areas or arterial roads
- Must be maintained to prevent clogging.

Design Checklist for Dry Well

- ❐ Volume and infiltrative area meet or exceed minimum.
- ❐ Overflow connected to a downstream storm drain or approved discharge point.
- ❐ Emergency spillage will be safely conveyed overland.
- ❐ Depth from bottom of the facility to seasonally high groundwater elevation is ≥10'.
- ❐ Areas tributary to the facility do not include automotive repair shops; car washes; fleet storage areas (Bus, truck, etc.); nurseries, or other uses that may present an exceptional threat to groundwater quality.
- ❐ Underlying soils are in Hydrologic Soil Group A or B. Infiltration rate is sufficient to ensure a full basin will drain completely within 96 hours. Soil infiltration rate has been confirmed.
- ❐ Set back from structures 10' or as recommended by structural or geotechnical engineer

Cistern or Vault with Bioretention Facility

A cistern or vault in series with a bioretention facility can meet treatment requirements where space is limited. In this configuration, the cistern or vault is equipped with a flow-control orifice and the bioretention facility is sized to treat a trickle outflow from the cistern or vault.

Best Uses

- In series with a bioretention facility to meet treatment requirement in limited space.
- Management of roof runoff
- Dense urban areas

Advantages

- Storage volume can be in any configuration

Limitations

- Somewhat complex to design, build, and operate
- Requires head for both cistern or vault and bioretention facility

▶ CRITERIA

Cistern or Vault. The cistern or vault must detain the volume calculated by Equation 4-8 and must include an orifice or other device designed for a 24-hour drawdown time.

Bioretention facility. See the design sheet for bioretention facilities. The area of the bioretention facility must be sized to treat the maximum discharge flow, assuming a percolation rate of 5" per hour through the engineered soil.

Use with sand filter. A cistern or vault in series with a sand filter can meet treatment requirements. See the discussion of treatment facility selection in Chapter 2 and the design guidance for sand filters in Chapter 4.

▶ DETAILS

Flow-control orifice. The cistern or vault must be equipped with an orifice plate or other device to limit flow to the bioretention area.

Preventing mosquito harborage. Cisterns and vaults should be designed to drain completely, leaving no standing water. Drains should be located flush with the bottom of the cistern. Alternatively—or in addition—all entry and exit points, should be provided with traps or sealed or screened to prevent mosquito entry. Note mosquitoes can enter through openings 1/16" or larger and will fly for many feet through pipes as small as ¼".

Exclude debris. Provide leaf guards and/or screens to prevent debris from accumulating in the cistern.

Ensure access for maintenance. Design the cistern or vault to allow for cleanout. Avoid creating the need for maintenance workers to enter a confined space. Ensure the outlet orifice can be easily accessed for cleaning and maintenance.

▶ APPLICATIONS

Shallow ponding on a flat roof. The "cistern" storage volume can be designed in any configuration, including simply storing rainfall on the roof where it falls and draining it away slowly. See the County of San Diego's 85th percentile isopluvial diagrams for required average depths.

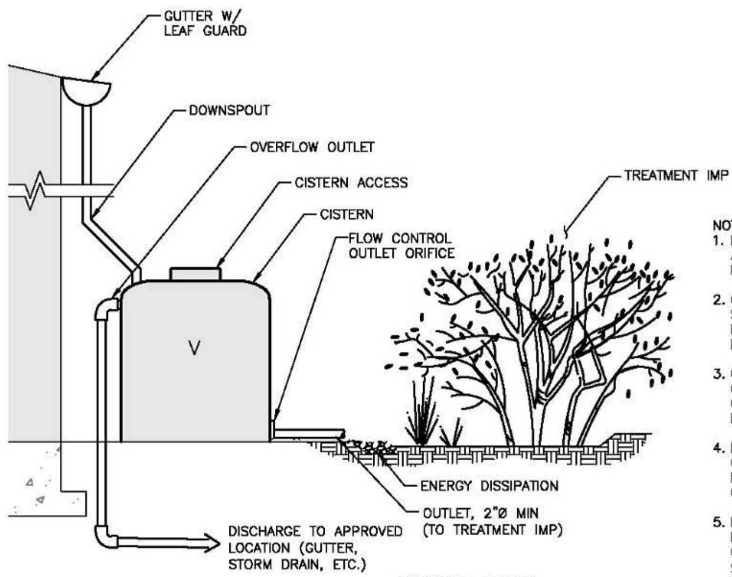
Cistern attached to a building and draining to a planter. This arrangement allows a planter box to be constructed with a smaller area.

Vault with pumped discharge to bioretention facility. In this arrangement, runoff from a parking lot and/or building roofs can be captured and detained underground and then pumped to a bioretention facility on the surface. Alternatively, treatment can be accomplished with a sand filter. See the discussion of selection of storm water treatment facilities in Chapter 2.

Water harvesting or gray water reuse. It may be possible to create a site-specific design that uses cisterns to achieve storm water flow control, storm water treatment, and rainwater reuse for irrigation or indoor uses (**water harvesting**). Facilities must meet criteria for capturing and treating the volume specified by Equation 4-8. This volume must be allowed to empty within 24 hours so runoff from additional storms, which may follow, is also captured and treated. Additional volume may be required if the system also stores runoff for longer periods for reuse. Indoor uses of non-potable water may be restricted or prohibited. Check with City staff.

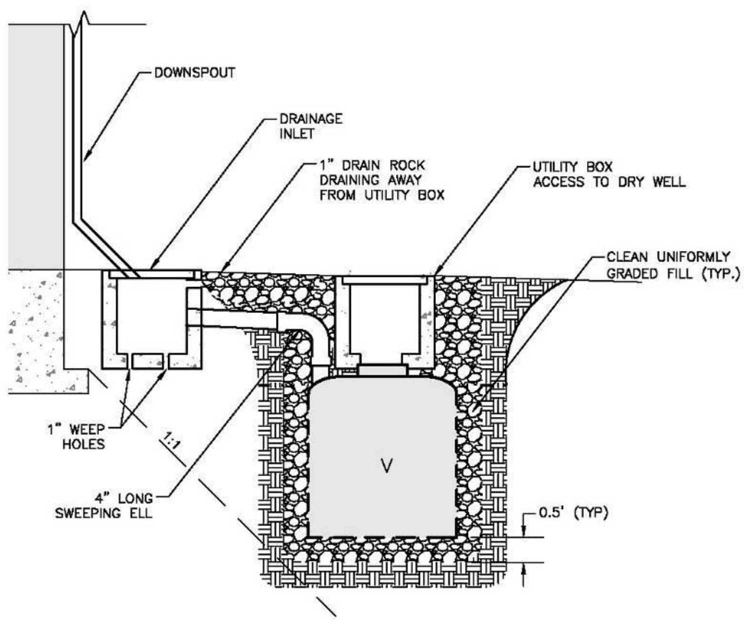
Design Checklist for Cistern or Vault

- ❐ Volume meets or exceeds minimum.
- ❐ Outlet with orifice or other flow-control device restricts flow and is designed to provide a 24-hour drawdown time.
- ❐ Outlet is piped to a bioretention facility designed to treat the maximum discharge from the cistern orifice.
- ❐ Cistern or vault is designed to drain completely and/or sealed to prevent mosquito harborage.
- ❐ Design provides for exclusion of debris and accessibility for maintenance.
- ❐ Overflow connected to a downstream storm drain or approved discharge point.
- ❐ Emergency spillage will be safely conveyed overland.



NOTES:
1. DESIGNER SHALL ACCOUNT FOR AND ACCOMODATE FOR POSSIBLE OVERFLOW.
2. OVERFLOW OUTLET CAPACITY SHALL EQUAL OR EXCEED POTENTIAL RUNOFF VOLUME AND RATE.
3. CISTERN PROVIDES FLOW CONTROL ONLY. USE IN COMBINATION WITH TREATMENT IMP.
4. PROVIDE ACCESS FOR CLEAN OUT OF OUTLET ORIFICE. SEE FLOW–THROUGH PLANTER OUTLET DETAIL.
5. PREVENT MOSQUITO BREEDING BY SEALING OR SCREENING ALL OPENINGS TO THE WATER SURFACE AND/OR ENSURE COMPLETE DRAINAGE.

CISTERN



DRY WELL

P:\Projects\San Diego County\133904 – SDCo Hydromod Management Plan\CAD\ES\Originals\CCCCP_Cistern.dwg 6-09-08 03:25:35 PM estfes

Appendix C

Storm Water Pollutant Sources/ Source Control Checklist

APPENDIX C — STORM WATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

How to use this worksheet (also see instructions in Step 4 of Chapter 3 of this SUSMP Manual):

1. Review Column 1 and identify which of these potential sources of storm water pollutants apply to your site. Check each box that applies.

2. Review Column 2 and incorporate all of the corresponding applicable BMPs in your Project-Specific SUSMP drawings.

3. Review Columns 3 and 4 and incorporate all of the corresponding applicable permanent controls and operational BMPs in a table in your Project-Specific SUSMP. Use the format shown in Table 3-1 in Step 4 of Chapter 3 of this SUSMP Manual. Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternatives.

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	**… THEN YOUR STORM WATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs**		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on SUSMP Drawings**	**3 Permanent Controls—List in SUSMP Table and Narrative**	**4 Operational BMPs—Include in SUSMP Table and Narrative**
❑ **A.** On-site storm drain inlets	❑ Locations of inlets.	❑ Mark all inlets with the words "No Dumping! Flows to Bay" or similar.	❑ Maintain and periodically repaint or replace inlet markings. ❑ Provide storm water pollution prevention information to new site owners, lessees, or operators. ❑ See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com ❑ Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR STORM WATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on SUSMP Drawings**	**3** **Permanent Controls—List in SUSMP Table and Narrative**	**4** **Operational BMPs—Include in SUSMP Table and Narrative**
❑ **B.** Interior floor drains and elevator shaft sump pumps		❑ State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer. ❑ State that proper permits or necessary approvals will be obtained for any drains connected to the sanitary sewer.	❑ Inspect and maintain drains to prevent blockages and overflow.
❑ **C.** Interior parking garages		❑ State that parking garage floor drains will be plumbed to the sanitary sewer. ❑ State that proper permits or necessary approvals will be obtained for any drains connected to the sanitary sewer.	❑ Inspect and maintain drains to prevent blockages and overflow.
❑ **D1.** Need for future indoor & structural pest control		❑ Note building design features that discourage entry of pests.	❑ Provide Integrated Pest Management information to owners, lessees, and operators.

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR STORM WATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on SUSMP Drawings**	**3** **Permanent Controls—List in SUSMP Table and Narrative**	**4** **Operational BMPs—Include in SUSMP Table and Narrative**
❑ **D2.** Landscape/ Outdoor Pesticide Use	❑ Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained. ❑ Show self-retaining landscape areas, if any. ❑ Show storm water treatment facilities.	State that final landscape plans will accomplish all of the following. ❑ Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. ❑ Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to storm water pollution. ❑ Where landscaped areas are used to retain or detain storm water, specify plants that are tolerant of saturated soil conditions. ❑ Consider using pest-resistant plants, especially adjacent to hardscape. ❑ To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	❑ Maintain landscaping using minimum or no pesticides. ❑ See applicable operational BMPs in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com ❑ Provide IPM information to new owners, lessees, and operators.
❑ **E.** Pools, spas, ponds, decorative fountains, and other water features.	❑ Show location of water feature, nearest landscaped areas, and nearest storm drains.	❑ Describe how water removed from the water feature would drain to nearby landscaping or be dechlorinated before discharge in accordance with City requirements.	❑ See applicable operational BMPs in Fact Sheet SC-72, "Fountain and Pool Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR STORM WATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on SUSMP Drawings**	**3** **Permanent Controls—List in SUSMP Table and Narrative**	**4** **Operational BMPs—Include in SUSMP Table and Narrative**
❑ **F.** Food service	❑ For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment. ❑ On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.	❑ Describe the location and features of the designated cleaning area. ❑ Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.	❑
❑ **G.** Refuse areas	❑ Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas. ❑ If dumpsters or other receptacles are outdoors, show how the designated area will be covered to prevent contact with rainfall, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area. ❑ Any drains from dumpsters, compactors, and grease or tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.	❑ State how site refuse will be handled and provide supporting detail to what is shown on plans. ❑ State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar. ❑ State that proper permits or necessary approvals will be obtained for any drains connected to the sanitary sewer.	❑ State how the following will be implemented: Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR STORM WATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on SUSMP Drawings**	**3** **Permanent Controls—List in SUSMP Table and Narrative**	**4** **Operational BMPs—Include in SUSMP Table and Narrative**
❑ **H.** Industrial processes.	❑ Show process area.	❑ If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."	❑ See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
❑ **I.** Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)	❑ Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area. ❑ Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults. ❑ Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.	❑ Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains. ❑ Where appropriate, reference documentation of compliance with the requirements of local Hazardous Materials Programs for: ▪ Hazardous Waste Generation ▪ Hazardous Materials Release Response and Inventory ▪ California Accidental Release (CalARP) ▪ Aboveground Storage Tank ▪ Uniform Fire Code Article 80 Section 103(b) & (c) 1991 ▪ Underground Storage Tank ❑ State that proper permits or necessary approvals will be obtained for any drains connected to the sanitary sewer.	❑ See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR STORM WATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on SUSMP Drawings**	**3** **Permanent Controls—List in SUSMP Table and Narrative**	**4** **Operational BMPs—Include in SUSMP Table and Narrative**
❑ **J.** Vehicle and Equipment Cleaning	❑ Show on drawings as appropriate: (1) Commercial/industrial facilities having vehicle /equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses. (2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shut-off to discourage such use). (3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. (4) Commercial car wash facilities shall be designed such that no runoff from the designated water area is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.	❑ If a car wash area is not provided, describe measures taken to discourage on-site car washing and explain how these will be enforced. ❑ State that proper permits or necessary approvals will be obtained for any drains connected to the sanitary sewer.	Describe operational measures to implement the following (if applicable): ❑ Wash water from vehicle and equipment washing operations shall not be discharged to the storm drain system. ❑ See Fact Sheet SC-21, "Vehicle and Equipment Cleaning," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR STORM WATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Show on SUSMP Drawings**	3 **Permanent Controls—List in SUSMP Table and Narrative**	4 **Operational BMPs—Include in SUSMP Table and Narrative**
❑ **K.** Vehicle/Equipment Repair and Maintenance	❑ Accommodate all vehicle equipment repair and maintenance indoors or designate a covered outdoor work area and design the area to prevent run-on and runoff of storm water. ❑ Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas. ❑ Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.	❑ State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area. ❑ State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements. ❑ State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.	In the SUSMP report, note that all of the following restrictions apply to use the site: ❑ No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinse water from parts cleaning into storm drains. ❑ No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately. ❑ No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR STORM WATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on SUSMP Drawings**	**3** **Permanent Controls—List in SUSMP Table and Narrative**	**4** **Operational BMPs—Include in SUSMP Table and Narrative**
❑ **L.** Fuel Dispensing Areas	❑ Fueling areas[3] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of storm water to the maximum extent practicable. ❑ Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area[1].] The canopy [or cover] shall not drain onto the fueling area.		❑ The property owner shall dry sweep the fueling area routinely. ❑ See the Business Guide Sheet, "Automotive Service—Service Stations" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

[3] The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR STORM WATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on SUSMP Drawings**	**3** **Permanent Controls—List in SUSMP Table and Narrative**	**4** **Operational BMPs—Include in SUSMP Table and Narrative**
❑ **M.** Loading Docks	❑ Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct storm water away from the loading area. Water from loading dock areas should be drained to the sanitary sewer where feasible. Direct connections to storm drains from depressed loading docks are prohibited. ❑ Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation. ❑ Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.	❑ State that proper permits or necessary approvals will be obtained for any drains connected to the sanitary sewer.	❑ Move loaded and unloaded items indoors as soon as possible. ❑ See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR STORM WATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on SUSMP Drawings**	**3** **Permanent Controls—List in SUSMP Table and Narrative**	**4** **Operational BMPs—Include in SUSMP Table and Narrative**
❑ **N.** Fire Sprinkler Test Water		❑ Provide a means to drain fire sprinkler test water to the sanitary sewer or to a landscaped area where there will be no discharge to the storm drain system. ❑ Obtain proper permits or necessary approvals for any drains connected to the sanitary sewer.	❑ See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
O. Miscellaneous Drain or Wash Water ❑ Boiler drain lines ❑ Condensate drain lines ❑ Rooftop equipment ❑ Drainage sumps ❑ Roofing, gutters, and trim.		❑ Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. ❑ State that proper permits or necessary approvals will be obtained for all drains connected to the sanitary sewer. ❑ Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. ❑ Rooftop mounted equipment with potential to produce pollutants shall be roofed and/or have secondary containment. ❑ Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water. ❑ Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.	

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR STORM WATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on SUSMP Drawings**	**3** **Permanent Controls—List in SUSMP Table and Narrative**	**4** **Operational BMPs—Include in SUSMP Table and Narrative**
❑ **P.** Plazas, sidewalks, and parking lots.			❑ Plazas, sidewalks, and parking lots shall be swept regularly to prevent the accumulation of litter and debris. ❑ Debris from pressure washing shall be collected to prevent entry into the storm drain system. ❑ Wash water from pressure washing activities shall be collected and discharged to the sanitary sewer and not discharged to a storm drain.

Appendix D

Bibliography and Suggested Resources

BASMAA. 1999. Bay Area Stormwater Management Agencies Association. *Start at the Source: Design Guidance Manual for Stormwater Quality.* Tom Richman and Associates. 154 pp. plus appendix.

BASMAA. 2003. *Using Site Design Techniques to Meet Development Standards for Stormwater Quality.* www.basmaa.org

CASQA. 2003. California Stormwater Quality Association. *California Stormwater BMP Handbooks.* Four Handbooks: *New Development and Redevelopment, Construction, Municipal, and Industrial/Commercial.* www.cabmphandbooks.org

County of San Diego. 2007. *Low Impact Development Handbook: Stormwater Management Strategies.* www.sdcounty.ca.gov/dplu/docs/LID-Handbook.pdf

County of San Diego. 2010. *Final Hydromodification Management Plan.* http://www.projectcleanwater.org/html/wg_susmp.html

Federal Interagency Stream Restoration Working Group. 1998. *Stream Restoration: Principles, Processes, and Practices.* http://www.nrcs.usda.gov/technical/stream_restoration/

Hampton Roads, VA. 2002. *Best Management Practices Guide.* Public Telecommunications Center. http://www.hrstorm.org/BMP.shtml

Low Impact Development Center. 2006. *LID for Big-Box Retailers.* 75 pp. http://lowimpactdevelopment.org/bigbox/

Maryland. 2000. State of Maryland. *Maryland Stormwater Design Manual.* www.mde.state.md.us/Programs/WaterPrograms/SedimentandStormwater/stormwater_design/index.asp

Portland. City of Portland, OR. *2004 Stormwater Management Manual.* http://www.portlandonline.com/bes/index.cfm?c=35117

Prince George's County, Maryland. 1999. *Low-Impact Development Design Strategies: An Integrated Design Approach.* Department of Environmental Resources, Programs and Planning Division. June 1999. 150 pp. http://www.epa.gov/owow/nps/lid/

Prince George's County, Maryland. 2002. *Bioretention Manual.* Department of Environmental Resources, Programs and Planning Division. http://www.goprincegeorgescounty.com/Government/AgencyIndex/DER/ESD/Bioretention/bioretention.asp

Puget Sound Action Team. 2005. Low Impact Development Technical Guidance Manual for Puget Sound. http://www.psat.wa.gov/Publications/LID_tech_manual05/lid_index.htm

Riley, Ann. 1998. *Restoring Streams in Cities.* Island Press, Washington, DC. 425 pp. www.islandpress.org/books/detail.html?SKU=1-55963-042-6

RWQCB. 2007. California Regional Water Quality Control Board for the San Diego Region. Order R9-2007-0001 (Stormwater NPDES Permit) www.waterboards.ca.gov/sandiego/

Salvia, Samantha. 2000. "Application of Water-Quality Engineering Fundamentals to the Assessment of Stormwater Treatment Devices." Santa Clara Valley Urban Runoff Pollution Prevention Program. Tech. Memo, 15 pp. www.scvurppp-w2k.com/pdfs/9798/SC18.02finalTM.pdf

Schueler, Tom. 1995. *Site Planning for Urban Stream Protection.* Environmental Land Planning Series. Metropolitan Washington Council of Governments. 232 pp. www.cwp.org/SPSP/TOC.htm

Washington Department of Ecology. 2001. Stormwater Management Manual for Western Washington. www.ecy.wa.gov/biblio/9911.html

Watershed Management Institute. 1997. *Operation, Maintenance, and Management of Stormwater Management Systems.*

WEF/ASCE. 1998. Water Environment Foundation/American Society of Civil Engineers. Urban Runoff Quality Management. WEF Manual of Practice No. 23, ASCE Manual and Report on Engineering Practice No. 87. ISBN 1-57278-039-8 ISBN 0-7844-0174-8. 259 pp. Access: Order from WEF or ASCE, www.wef.org or www.asce.org

Appendix E

Hydromodification Management Plan